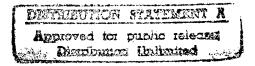


# PROGRAMMING DOCUMENTS

# ENERGY ENGINEERING ANALYSIS PROGRAM

# LIMITED ENERGY STUDY OF STEAM DISTRIBUTION SYSTEMS

# HAWTHORNE ARMY AMMUNITION DEPOT HAWTHORNE, NEVADA



### PREPARED FOR

DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT, CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

### PREPARED BY

KELLER & GANNON ENGINEERS • ARCHITECTS 1453 MISSION STREET, SAN FRANCISCO, CA 94103

CONTRACT NO. DACA 05-C-92-0155

### DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS P.O. BOX 9005 CHAMPAIGN, ILLINOIS 61826-9005

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Marie Wakefield, Librarian Engineering

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1. COMPONENT Army	FY 1996 MILITARY CO	ATA 2. DATE September 1995	
3. INSTALLATION AND LOCATION  Hawthorne Army Ammunition Depot Nevada		4. PROJECT TITLE ECIP Modernize Industr	rial Area Steam Distribution
5. PROGRAM ELEMENT	6. CATEGORY CODE 8000	7. PROJECT NUMBER 40667	8. PROJECT COST (\$000) 883.1

### 9. COST ESTIMATES

Item	U/M	Quantity	Unit Cost	Cost (\$000)
Primary Facilities, replace various piping in concrete trenches and direct buried:				693.7
Manhole A5 to Manhole A9	LF	1,940	77.48	(150.3)
Rerouting for Buildings 3, 35 and 36	LF	1,316	108.94	(143.4)
East U Street Piping	LF	1,835	78.29	(143.7)
Family Housing Condensate Pipe	LF	3,599	71.24	(256.4)
Supporting Facilities	LS	_		0
Estimated Contract Cost				693.7
Contingency 10%				69.4
Subtotal				763.1
Supervision, Inspection and Overhead 5.6%				42.7
Design 6%				45.8
Unescalated CWE				851.6
Escalation to Midpoint of Construction: 1 December 1996				31.5
Total Request				883.1

### 10. DESCRIPTION OF PROPOSED CONSTRUCTION

Replace about 8,690 linear feet of steam and condensate piping in the Industrial Area. Replacement piping shall be installed to replace selected existing piping in shallow concrete trenches and direct buried installations. Existing deteriorated piping will be removed from concrete trenches; existing direct buried piping being replaced will be abandoned in place. For concrete trenches, new steam service piping will be schedule 40 steel pipe and new condensate piping will be schedule 80 steel pipe. Insulation and aluminum jacketing will be sized and field installed in accordance with the latest requirements of Corps of Engineers Guide Specification (CEGS) 02696, Heat Distribution Systems in Concrete Trenches. Piping to replace existing buried pipes will be preengineered conduit systems in separate conduits. Service pipes will be of the same type as in concrete trenches. Insulation and conduit will be as specified in CEGS 02695, Preapproved Underground Heat Distribution System.

Validation of savings: Energy savings will be measured by comparing the fuel consumption for the heating plant in building 13 before and after the new steam and condensate piping is installed. The heating requirements, including heating degree days and building utilization, will be taken into account when comparing the consumption values.

<u>PROJECT</u>: Replace approximately 8,690 LF of selected steam and condensate return piping in the Industrial Area currently direct buried or installed in shallow concrete trenches.

<u>REQUIREMENT</u>: This project will contribute toward achieving Department of Defense facility energy goals of a 20-percent reduction in energy use per gross square feet by FY2000 versus FY1985 baseline levels.

This project will save \$248,042 annually, comprised of \$145,423 from fuel oil savings and \$102,620 per year from maintenance cost savings. These savings result in a 3.43-year simple payback period and a savings-to-investment ratio of 3.87. Annual fuel savings are estimated at 23,723 Million BTU per year.

<u>CURRENT SITUATION</u>: Selected existing direct buried and concrete trench steam supply and condensate return piping is in a deteriorated state. Much of this piping is over twenty years old and is corroded and/or leaking. Uninsulated fiber reinforced plastic (FRP) piping used for condensate return from the family housing area is melted in many locations due to exposure to temperatures above 250 degrees F.

Much of the existing insulation is deteriorated and leakage of steam and condensate is prevalent. Repairs to the existing systems are required frequently and are becoming more costly due to the deteriorated state of the systems and the need to excavate to locate the leaks.

IMPACT IF NOT PROVIDED: If this project is not accomplished, annual expenses of about \$248,042 for fuel and maintenance will be incurred that could have been avoided. Additionally, the potential of loosing heating service to buildings served will be greatly increased. If this project is not approved, it will have a negative impact on the HWAAD energy program and will impede progress towards compliance with DEPPM 91-2.

<u>ADDITIONAL</u>: This project has been coordinated with the installation security plan, and no security improvements are required. This project incorporates recommendations of the Energy Engineering Analysis Program, Limited Energy Study of Steam Distribution Systems, performed under Contract No. DACA05-92-C-0155.

This installation is not under consideration for realignment or closure.

JOHN G. ZODROW Lt. Colonel Commanding

Estimate Date: 1 September 1995

Estimated Construction Start: 1 September 1996
Estimated Midpoint of Construction: 1 December 1996
Estimated Construction Completion: 1 March 1997

Index: 1975

Index: 2032

Index: 2048 Index: 2060 LOCATION: Hawthorne Army Ammunition Depot, Nevada Date: September 1995

PROJECT TITLE: ECIP Modernize Industrial Area Steam Distribution

### **Detailed Justification**

- 1. GENERAL: The project is a significant part of Hawthorne Army Ammunition Depot's effort to achieve a 20-percent reduction in energy consumption by FY2000 versus FY1985 baseline levels. The project will also assure that heating services are provided to Industrial Area facilities on a continuing basis, supporting mission requirements.
- 2. ACCOMMODATIONS NOW IN USE: Not applicable.
- 3. ANALYSIS OF DEFICIENCY: The present condition of steam distribution and condensate collection piping contributes to unnecessary annual energy consumption and maintenance expenses totaling about \$248,042 per year. These costs will be avoided with implementation of the proposed project.
- 4. CONSIDERATION OF ALTERNATIVES: Alternative piping materials and placement methods were considered. The least costly alternatives are recommended for implementation. The recommended retrofits are those selected in the Limited Energy Study of Steam Distribution Systems, September 1995, prepared under Contract No. DACA 05-C-92-0155.
- 5. CRITERIA FOR PROPOSED CONSTRUCTION: Design and construction will be in accordance with applicable criteria established in:
  - a. DOD 4270.1-M
  - b. TM 810-5
  - c. Architectural and Engineering Instruction, dated 9 December 1991
  - d. A-E Guide Instruction for Army Projects, Volume 1, dated January 1990
  - e. A-E Guide, CESPK Cost Estimating Guide, Volume 2, dated December 1989
  - f. A-E Guide Volume III, Specifications, dated December 1990
  - g. Energy Conservation Investment Program (ECIP) Guidance, dated 10 January 1994.
  - h. TM 5-785, Engineering Weather Data
  - i. MCASES instructions
  - j. TM 5-652, Steam / Hot Water and Chilled Water Distribution Systems Operations and Maintenance Manual
  - k. CEGS-02695, Preapproved Underground Heat Distribution System
  - 1. CEGS-02696, Heat Distribution Systems in Concrete Trenches
  - m. CEGS-02697, Aboveground Heat Distribution System
- 6. PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT: Not applicable.
- 7. DISPOSAL OF PRESENT ASSETS: Not applicable.
- 8. SURVIVAL MEASURES: Not applicable.

LOCATION: Hawthorne Army Ammunition Depot, Nevada Date: September 1995 PROJECT TITLE: ECIP Modernize Industrial Area Steam Distribution

- 9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES: Atmospheric emissions will be reduced as less fuel will be used due to this project. Temporary conditions will exist during the construction period consisting primarily of fugitive dust emissions.
- 10. EVALUATION OF FLOOD HAZARDS AND ENCROACHMENT ON WETLANDS: Not applicable
- 11. ECONOMIC JUSTIFICATION: In accordance with ECIP Guidance dated 10 December 1994, an economic analysis has been prepared. Life-cycle cost analysis results are summarized as follows:

•	Estimated Construction Cost (including	SIOH and design costs)	\$851,618
•	Annual Energy Savings	23,723 MBTU (4,	167,500 MJ)
•	First Year Energy Cost Savings		\$145,423
•	First Year Non-energy Cost Savings		\$102,620
•	Total First Year Cost Savings		\$248,042
•	Discounted Energy Savings		\$2,069,366
•	Discounted Non-energy savings		\$1,225,277
•	Total Net Discounted Savings		\$3,294,643
•	Savings-to-Investment Ratio		3.87
•	Simple Payback Period		3.43 years

Refer to "Detailed Calculations" for backup data.

- 12. UTILITY AND TELECOMMUNICATIONS SUPPORT: Not applicable.
- 13. PROTECTION OF HISTORIC PLACES AND ARCHEOLOGICAL SITES: Review procedures have been implemented for this project in accordance with 36 CFR 800. The review has established that there will be no effect.
- 14. PROJECT DEVELOPMENT BROCHURE: A Project Development Brochure (PDB-1) dated September 1995 has been prepared.
- 15. ENERGY REQUIREMENTS: Not applicable.
- 16. PROVISION FOR THE HANDICAPPED: Not applicable.
- 17. REAL PROPERTY MAINTENANCE ACTIVITY ANALYSIS: Not applicable.
- 18. COMMERCIAL ACTIVITIES: This project involves replacement or modification of existing systems for energy conservation. Under these conditions, the provisions of AR 5-XX do not apply, and a "new start or expansion" is not required.

### Life Cycle Cost Analysis Summary - Industrial Area **Energy Conservation Investment Program (ECIP)**

Hawthorne Army Ammunition Depot Region No. 4 Project No. 40667 Project Title: ECIP Modernize Industrial Area Steam Distribution Fiscal Year **FY97** Discrete Portion: Total Project Preparer: KELLER & GANNON Analysis Date September 1995 Economic Life: 15 Years 1. Investment Costs A. Construction Costs \$763,099 B. SIOH 5.6% \$42,734 C. Design Cost 6.0% \$45,786 D. Total Cost (1A + 1B + 1C) \$851,618 E. Salvage Value of Existing Equipment \$0 F. Public Utility Company Rebate \$0 G. Total Investment (1D-1E-1F) \$851,618 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Saving Annual \$ Discount Discounted Source \$/MBTU MBTU/Yr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82 0 \$0 12.02 \$0 B. Dist \$6.13 23,723 \$145,423 14.23 \$2,069,366 C. LPG D. Other E. Demand Savings 0.0 kW 11.30 \$0 F. Total 23,723 \$145,423 \$2,069,366 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) \$102,620 (1) Discount Factor (Table A) 11.94 (2) Discounted Savings/Cost (3A x 3A1) \$1,225,277 B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Discount Year of Discounted Sav-Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4) a. b. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) \$1,225,277 4. First Year DollarSavings (2F3+3A+(3Bd1/Economic Life)): \$248,042 5. Simple Payback (1G/4): 3.43 Years 6. Total Net Discounted Savings (2F5 + 3C): \$3,294,643 7. Savings to Investment Ratio (SIR) (6/1G): 3.87

Location:

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### **Comparison of Replacement Piping Alternatives**

A typical pipe section is evaluated for each area. The Industrial Area is, nowadays, more of an administrative and maintenance yard area. Both assume the use of mineral fiber insulation. All but a few sections of pipe are underground. Existing installations include direct buried pipe, pipe in concrete trenches and some conduit encased direct buried piping. Only underground replacement piping is considered.

Alternatives consider both prefabricated piping systems and built-up piping systems. The costs summarized below are intended exclusively for comparing one type of system against another. Some cost elements that affect all alternatives equally are not considered.

A common pipe run in the Industrial Area, and the pipe sizes used to evaluate alternatives, consists of a 4-inch diameter steam pipe and a 3-inch diameter condensate return pipe. Direct burial of single and double pipe conduit are considered. Replacement of pipes in concrete trenches with conduit systems and with built-up piping is considered. Unlike the alternatives shown for the Ordnance Area, the pipes in the Industrial Area do not include allowances for thermal expansion loops; expansion will be accommodated in expansion joints. Cost estimates for comparison pipe segments follow.

Direct	Bury	<b>Alternatives</b>
DIICCL		VIICI Hallace

### Comparison First Cost \$/LF

Alternative DB1:

14-inch Conduit containing 4-inch Schedule 40 Steam Pipe with

\$104.95

\$135.29

\$125.87

\$102.10

2-inch Insulation and 3-inch Schedule 80 Condensate Pipe with

1-Inch Insulation Direct Bury

**Alternative DB2:** 

10-3/4-inch Conduit containing 4-inch Schedule 40 Steam Pipe

with 2-inch Insulation &

6-inch Conduit with 3-inch FRP Condensate Pipe with 1-Inch

Insulation Direct Bury

Alternative DB3:

10-3/4-inch Conduit containing 4-inch Schedule 40 Steam Pipe

with 2-inch Insulation &

8-5/8-inch Conduit with 3-inch Schedule 80 Cond Pipe with

1-Inch Insulation Direct Bury

# Replace Pipes in Existing Concrete Trench Alternatives

### Comparison First Cost \$/LF

**Alternative CT1:** 

14-inch Conduit containing 4-inch Schedule 40 Steam Pipe with

2-inch Insulation and 3-inch Schedule 80 Condensate Pipe with

1-Inch Insulation Conc Trench

**Alternative CT2:** 

10-3/4-inch Conduit containing 4-inch Schedule 40 Steam Pipe

\$130.90

with 2-inch Insulation &

6-inch Conduit with 3-inch FRP Condensate Pipe with 1-Inch

Insulation Conc Trench

**Alternative CT3:** 

10-3/4-inch Conduit containing 4-inch Schedule 40 Steam Pipe

\$123.02

with 2-inch Insulation &

8-5/8-inch Conduit with 3-inch Schedule 80 Cond Pipe with

1-Inch Insulation Conc Trench

Alternative CT4:

4-inch Schedule 40 Steam Pipe with 2-inch Insulation and

\$70.57

Aluminum Jacket &

3-inch Schedule 80 Condensate Pipe with 1-Inch Insulation &

Aluminum Jacket

## **Comparison of Replacement Piping Alternatives**

### Comparison of Repair Costs

Repairs are more difficult, and costly, for two-pipe conduit systems and for buried pipe systems. Repairs for conduit systems require that the conduit be opened up and the leaking section replaced. For two-pipe conduit systems, both pipes are replaced when one is found leaking. Repair costs are similar to original installation costs. Repairs to single pipe conduit systems are less costly, but still involve cutting through and repairing both the service pipe and the conduit. Repairs to piping in concrete trenches do not incur the expense of re-excavating, nor is there the same level of danger of accidentally digging into the pipe. Repairs to above ground piping systems are the least expensive.

Maintenance costs are higher for systems which contain FRP piping because thermal protective devices installed on all condensate entries must be maintained and defective parts replaced. The installed cost per LF of these protective devices is expensed twice during the life of the piping to represent additional maintenance and repairs required for these systems. Results are indicated below.

For purposes of comparison, frequencies of repair during a pipe segment's lifetime are considered. Results are shown below.

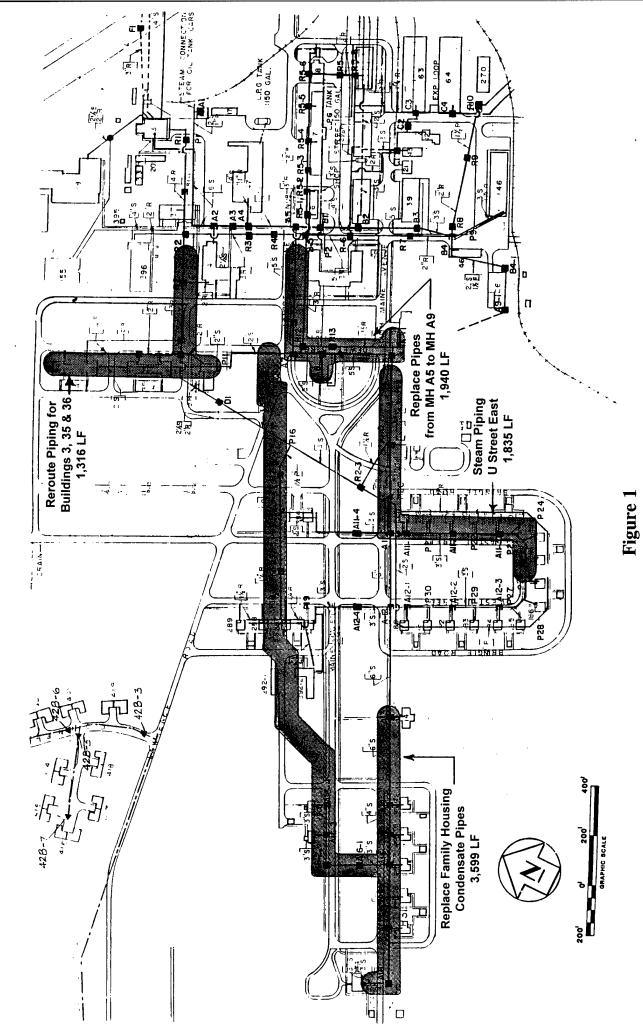
# **Recommended Replacement Piping Configurations**

Descriptions of Alternatives	\$/LF	Repairs/ Life	Added Maint	Overall Cost/LF
Direct Bury Alternatives				
Alternative DB1	\$104.95	1	\$0.00	\$209.91
Alternative DB2	\$135.29	0.75	\$70.26	\$307.02
Alternative DB3	\$125.87	0.5	\$0.00	\$188.80
Replace Pipes in Existing Con	crete Trend	h Alternati	ives	•
Alternative CT1	\$102.10	1	\$0.00	\$204.20
Alternative CT2	\$130.90	0.75	\$70.26	\$299.33
Alternative CT3	\$123.02	0.5	\$0.00	\$184.53
Alternative CT4	\$70.57	0.25	\$0.00	\$88.22

Table 1
Summary of Piping Replacement Costs
Industrial Area Steam Distribution

### Recommended **Alternative Description \$/LF Total LF** Cost \$ Replace Pipes MH A5 to MH A9 \$85.23 1,940 \$165,343 Rerouting for Buildings 3, 35 & 36 \$119.83 1,316 \$157,696 Steam Piping - U Street East \$86.12 1,835 \$158,033 Family Housing Condensate Pipes \$78.36 3,599 \$282,027 **Total of Industrial Area Alternatives** \$94.54 8,690 \$763,099 SIOH 5.6% \$42,734 Design 6.0% \$45,786 **Total Request** \$851,618 \$105.50 8,690

Refer to Figure 1 for locations of piping replacements



Recommended Steam Distribution System Piping Replacements

# Annual Energy and Maintenance Cost Savings Calculations Hawthorne Army Ammunition Depot - Industrial Area

Replacing existing deteriorated piping will save both energy and maintenance costs. Energry savings result from reducing leakage from steam and condensate pipes and from reduced conduction/convection losses due to the installation of replacement piping with proper insulation.

# **Energy Savings Calculations**

### **Boiler Plant Name Plate Data**

### **Boiler Building 13 - Industrial Area**

Boilers: 3 Each Fire 7		ube Boilers	be Boilers Operating Pressure:		105 psig, at		341 °F
		h <sub>1</sub> =	312 BTU/LB	$h_{fg} =$	877.9	BTU/Lb	
		Manufacturer:	Nebraska Co	ompany, Inc.			
		Serial Nos.:		2D1637	2D1638	2D1639	
		National Board	l Nos.:	1599	1600	1601	
		Maximum AWI	<sup>o</sup> (psig):	250	250	250	
		Boiler Heating	Surface:	2,007 SF	2,007 SF	2,007 SF	
		Year Built:		1974	1974	1974	
		Rated Steam (	Capacity:	18 KLB/HR	18 KLB/HR	18 KLB/HR	
		Boiler Fuel:		No. 2 Diesel	Fuel Oil (Hi	gh Sulfur)	
Boiler Fee	d Pumps:	2 Each, Myers	Centrifugal, 1	I5 HP each, 1	-1/2-inch inl	ets	
Boiler Effic	ciency Tests:	Boiler No.	Oxygen %	Temp °F	Eff %	Condition	
		13-1	8.8%	290	86.0%	Boiler Cold	

Boiler Efficiency Tests:	Boiler No.	Oxygen %	Temp °F	Eff %	<b>Condition</b>
	13-1	8.8%	290	86.0%	Boiler Cold
	13-1	5.1%	440	82.9%	High Fire
	13-2	1.0%	310	88.3%	Boiler Cold
	13-2	9.1%	-	84.2%	High Fire
	13-3	3.6%	350	86.6%	Boiler Cold
	13-3	4.6%	360	82.7%	High Fire

For plant efficiency calculations, the high firing efficiency is used since it more closely follows actual operations.

# **Boiler Plant Efficiency Calculations**

	Steam Plant	
Firing (Combustion) Efficiency Test	Bldg 13 83.2%	Moightod average of officiencies
Auxiliary Equipment Uses	-2.0%	Weighted average of efficiencies allowance for steam ejectors
Radiation Losses @ Figure D-1	-2.0%	allowance for steam ejectors
Blowdown Losses (Continuous BD)	-1.5%	
Leaks (Minimal at boiler houses)	-1.0%	Not including distribution leakage
Conduction/Convection	-2.5%	9
(Plant only, not including distribution piping; sys	stems rated in "poor"	condition due only to age, well maintained.)
Shut-Down/Cycling Losses	-4.0%	Boilers oversized for current load.
General Equipment Condition	-3.0%	
(Plant only systems rated in "poor" condition of	due only to age, well i	maintained.)

**Overall Plant Efficiencies** 

67.2%

# Steam Leakage and Condensate Energy Loss Calculations

Makeup water records are summarized for each of the boiler system. Steam production data is not available.

### Steam Plant

Bldq 13

Most recent calendar year May '94 through April '95:

3,429,870 Gallons

Calendar Year 1994:

3,090,330 Gallons

The most recent calendar year data is used in steam and condensate energy loss calculations.

These losses include both steam and condensate leaks. Steam leakage represents a much greater energy loss than does the leakage of condensate. This is illustrated below:

Energy needed to raise makeup water from 50°F (raw water temperature) to 200°F, the condensate return temperature: 150.0 BTU per pound water

Energy needed to raise the 200°F condensate to 341°F, the saturation temperature of 105 psig steam: 144.4 BTU per pound water

Energy needed to vaporize 341°F water at 105 psig (heat of evaporation):

877.9 BTU per pound water

Thus, a steam leak includes loss of the useful work the steam can perform (heat of evaporation) and the energy required to heat makeup water to the vaporization temperature, all three of the above elements, or 1,172.2 BTU per pound water

A condensate leak includes only the energy needed to raise raw makeup water to the condensate return temperature, or 150.0 BTU per pound water

The following calculation shows the percent of total steam plant fuel consumption represented by steam and condensate losses where total losses are attributed exclusively to either steam or condensate.

### Steam Plant Bldg 13 **Energy Losses** KK BTU/Yr % Total Fuel If Leakage is 100% Steam: 33.572 55.4%

If Leakage is 100% Condensate: 8,430 13.9%

Assumes water temp of 50 °F, h<sub>i</sub> = 18.1 BTU/LB ; Fuel Oil at 138,700 BTU/Gallon

Based on field observations, it appears that most of the makeup water loss is composed of condensate that is not returned to the central plant. There are only a few steam leaks. Conservatively, then, assume 10% of the losses in the Industrial Area are from condensate. Blowdown is included in makeup water requirements and constitutes about 2% of the total steam flow. This use is subtracted from the loss calculations below. The annual energy savings from repairs to the distribution systems are:

Indi	ıstrial	Area	
Steam	Plant	Bldg	13

Energy Losses	KK BTU/Yr
Loss from Steam Leakage	3,357
Loss from Condensate Leakage	7,587
Thermal Losses	10,944
Boiler Plant Efficiency	67.2%
Makeup Water Fuel Uses	16,290
Blowdown Loss (2% of fuel input)	1,213
Leakage Fuel Losses (No 2 Fuel Oil)	15,077

Significant additional losses occur from poorly insulated steam and condensate lines. Leakage of steam and condensate has wetted the insulation (if present) to such an extent that little insulating value remains.

## **Energy Savings from Piping Insulation Losses**

Existing piping is deteriorated and leaks have destroyed the value of insulation installed on existing piping. Insulation thermal losses are determined for existing and proposed future piping systems. Detailed calculations follow. Results are summarized here:

Energy Savings	Industrial Area Steam Plant Bldg 13 KK BTU/Yr
Load Saved (Heating Season Only)	5,809
Boiler Plant Efficiency	67.2%
Insulation Savings (No 2 Fuel Oil)	8,646
Total Fuel Oil Savings	23,723

## **Operation and Maintenance Cost Savings**

The proposed new piping systems will reduce operation and maintenance costs significantly. Cost savings for each area are determined below.

Industrial area steam leaks and condensate piping breaks create a chronic problem for the maintenance staff. Service calls to repair the distribution system seem to be a daily occurrence. The proposed repairs will replace most of the fiber reinforced plastic (FRP) piping used for condensate return from the housing area. Repairs have been frequent because the piping is damaged every time steam bypasses a trap and enters the FRP piping inadvertently. The piping is not rated for service above 250°F. One incedent of 100 psig steam entering FRP condensate piping exposes the material to a temperature of at least 340°F.

Other repairs proposed will consolidate steam and condensate piping into the shallow concrete trench system. Repairs to the condensate piping, currently direct buried, will be made more accessible (and less expensive).

Overall, the piping replacements in the Industrial Area are expected to save about 3/4 of present maintenance costs according to maintenance supervisors. During the last year for which records are available, about 3,700 hours per year were spent on preventive maintenance, service calls and on major repairs. Based on a steamfitter rate of \$42.33 per Hour and helper rate of \$31.63 (Means Steamfitter & Helper, location adjusted) and 3/4 of the total maintenance hours, savings are expected to total:

3,700 hours year x 3/4 x \$36.98 per hour = \$102,620 per year, including overhead.

# Thermal Loss Calculations for New and Deteriorated Existing Steam Distribution & Condensate Piping <u>Piping Systems</u>

Source: Siddiqui, M.K., Calculations for Insulated Pi Source: Siddiqui, M.K., Calculations for Insulated Pi Piping Layout (1=AG; 2=UG): Outer Pipe Diameter (Inches): Service Temperature: Insulation Conductivity at TM1 (BTUH-IN/SF-°F): Insulation Conductivity at TM2 (BTUH-IN/SF-°F): Pipe Orientation (1=Horizontal; 2=Vertical): Ambient Air Temperature (°F): Wind Speed (MPH): Surface Emittance: Average Annual Soil Temperature: Thermal Conductivity of Soil (BTUH-In/SF-°F): Burial Depth to Centerline of Pipe (FT): Insulation Thickness (Inches):	Source: Siddiqui, M.K., Calculations for Insulated Piping Systems, Heating/Piping/Air Conditioning, November 1994  Piping Layout (1=AG; 2=UG):  Outer Pipe Diameter (Inches):  Service Temperature: Insulation Conductivity at TM2 (BTUH-IN/SF-°F): Pipe Orientation (1=Horizontal; 2=Vertical):  Normally Horizontal Ambient Air Temperature: Surface Emittance: Average Annual Soil Temperature: Average Annual Soil (BTUH-In/SF-°F): Burial Depth to Centerline of Pipe (FT):  Solution:  Solution:  Solution:  See Table below for actual sizes  Hor Steam 338°F, LP Steam 250°F, Condensate 200°F  Hor Steam 338°F, LP Steam 250°F, Condensate 200°F  Brail Depth (and Emittance):  Solution:  Soluti
Inner Diameter of Pipe (Inches):	See below for pipe size and service
Thermal Conductivity for Direct Burried Pipe (BTU-In/(Hr-SF-°F):	//(Hr-SF-°F): Red Brass = 2,784 FRP = 2.30

Nominal Pipe Size	~	1.25	1.5	7	2.5	က	4	2	9	œ
Pipe Diameter Schedule 40 for Steam Service	40 for St	eam Se	rvice							
Pipe OD (Inches)	1.182	1.52	1.755	2.221	2.672	3.284	4.263	5.305	6.345	8.303
Pipe ID (Inches)	1.049	1.38	1.61	2.067	2.469	3.068	4.026	5.047	6.065	7.981
Insulation Thickness (Min	eral Wool	-								
Above Ground (Inches)	2.5	2.5	2.5	3.5	3.5	4.0	4.0	4.0	4.5	4.5
Pipe Trench (Inches)	2.0	2.0	2.5	2.5	2.5	3.0	3.0	3.0	3.5	3.5
UG Conduit (Inches)	2.0	2.0	2.0	2.5	2.5	3.0	3.0	3.0	3.5	3.5
Conduit Casing (Inch)	6.625	6.625	6.625	8.625	8.625	10.750	12.750	12.750	16.000	18.0
Air Space (Inches)	0.813	0.688	0.563	0.813	0.563	0.875	1.375	0.875	1.500	1.500
Pipe Diameter Schedule 80 for Condensate Service	80 for Co	ndensa	ite Servi	ce						
Pipe OD (Inches)	1.136	1.469	1.7	2.157	2.599	3.2	4.163	5.188	6.193	8.125
Pipe ID (Inches)	0.957	1.278	1.5	1.939	2.323	2.9	3.826	4.813	5.761	7.625
Insulation Thickness (Mineral Wool)	eral Wool)									
Above Ground (Inches)	2.0	2.0	2.0	2.0	2.0	2.5	2.5	,	,	,
Pipe Trench (Inches)	1.5	1.5	1.5	1.5	1.5	2.0	2.0	•	,	•
UG Conduit (Inches)	1.5	1.5	1.5	1.5	1.5	2.0	2.0	,	ı	
Conduit Casing (Inch)	6.625	6.625	6.625	8.625	8.625	10.750	10.750	,	ı	ı
Air Space (Inches)	1.313	1.188	1.063	1.813	1.563	1.875	1.375	ı	•	,

Thermal Loss Calculations for New and Deteriorated Existing Steam Distribution & Condensate Piping

		,	,	1						,	,	,		4	Brass	290.0
		ı		,			,			ı		,				270.4 2
			,							,			Pipe			251.0 2
		ı	,			,							3are Pi	7	ass F	44.9 2
2.5 LPS		,	37.9	: .		ı			2.5 LPS	) i ,	100.4	· •	uried E	2	R Br	221.6 244.9
2.5			m						2.5	i i	10	•	8			232.2 22
m		•	•	•		'	•		"	'		'				
2 LPS		1	34	١		ı	•		2 LPS		86.6			1.5	FRP	201.4
ω		78.0	91.2	81.6		٠	•	,		411.1	374.0	263.4		•	•	1
9		65.0	75.3	67.9		,	ı	,		322.3	293.5	217.7		ı	1	•
ĸ		62.3	73.5	66.1		,	,	1		274.8	250.5	189.0			,	•
4		54.3	63.5	57.7		39.7	44.5	38.7		226.9	207.0	163.8	n	120.8	109.2	197.0
က		46.6	53.9	49.2		33.4	37.2	32.7	ing	81.5	0.99	34.7	d Pipin	9.96	87.5	175.8
2.5		44.6	52.7	48.0		33.4	38.3	33.7	Ω	152.9	140.1 166.0	115.8 1	<b>Deteriorated Piping</b>	81.4	73.9	
2	ğ	40.4	47.3	43.3	/ Piping	29.8	33.9	30.1	.≃						63.8	139.8
1.5	ew Pipir	42.3	41.5	42.5	ice, New	25.9	29.3	26.0	kisting,	109.5	100.8	86.9	ice, Exis	58.3	53.2	106.5 116.1
1 1.25 1.5	rvice, N	39.2	37.6 42.9 41.5	34.8 37.5 42.5	ate Serv	23.9	26.9	24.0	rvice, E	98.2	75.6 90.5 100.8 120.9	67.2 79.2 86.9 102.5	te Serv	52.3	47.8	106.5
-	team Se	34.6	37.6	34.8	ondens	18.9	23.3	20.9	eam Se	81.8	75.6	67.2	ondensa	43.5	39.9	90.3
Nominal Pipe Size	Nominal Size Sch 40 for Steam Service, New Piping	Above Ground (BTUH/LF) 34.6 39.2 42.3 40.4	Pipe Trench (BTUH/LF)	UG Conduit (BTUH/LF)	Nominal Size Sch 80 for Condensate Service, New Piping	Above Ground (BTUH/LF) 18.9 23.9 25.9 29.8	Pipe Trench (BTUH/LF)	UG Conduit (BTUH/LF)	Nominal Size Sch 40 for Steam Service, Existing, Deter	Above Ground (BTUH/LF) 81.8 98.2 109.5 131.7	Pipe Trench (BTUH/LF)	UG Conduit (BTUH/LF)	Nominal Size Sch 80 for Condensate Service, Existing,	Above Ground (BTUH/LF) 43.5 52.3 58.3 70.1	Pipe Trench (BTUH/LF)	UG Conduit (BTUH/LF)

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Thermal Savings for Industrial Area Steam Distribution System Piping Replacements

		Existing	Proposed		ong	Quantity			Thermal S	Savings
Location	Service	Placement	Placement	Surface	No. Units	Unit Meas.	Current BTUH/LF	Proposed BTUH/LF	Heat Load Saved BTUH	KK BTU/Yr Saved
Pipe Replacement Bldg 13 to	_	MH B4 (Alternative	native 1)							
MH B1 to Bldg 6	2" (40) HPS	Conc Trench	Conc Trench	Conc Trench	느	32	120.9	47.3	2,355	10
MH B2 to MH B3	2" (80) Cond		Conc Trench	Conc Trench	5	198	244.9	33.9	41,778	183
MH B2 to MH B3	2" (80) Cond	DB Red Brass	$\sim$	Conc Road	LF	25	244.9	33.9	5,275	23
MH B3 to MH B4	2" (80) Cond	DB Red Brass		Asphalt	H.	75	244.9	30.1	16,110	7.1
MH B3 to MH B4	2" (80) Cond	DB Red Brass		Conc Road	F.	22	244.9	30.1	4,726	21
MH B3 to MH B4	3" (40) HPS	Direct Bury	DB Conduit	Asphalt	느	75	492.7	49.2	33,263	146
MH B3 to MH B4	3" (40) HPS	Direct Bury	DB Conduit	Conc Road	느	22	492.7	49.2	9,757	43
MH A2-1 to MH A5	3" (80) Cond	DB Red Brass		Lawn	<u>Ľ</u>	349	270.4	37.2	81,387	356
MH A5 to MH B1	3" (80) Cond	DB Red Brass	_	Conc Trench	L	44	270.4	37.2	10,261	45
MH B1 to MH B2	3" (80) Cond	DB Red Brass	Conc Trench	Conc Trench	LF	102	270.4	37.2	23,786	104
MH B1 to MH B2	3" (80) Cond	DB Red Brass		Conc Road	느	25	270.4	37.2	5,830	26
MH B1 to MH B2	4" (40) HPS	Conc Trench	Conc Trench	Conc Trench	占	102	207.0	63.5	14,637	64
MH B1 to MH B2	4" (40) HPS	Conc Trench	Conc Trench	Conc Road	占	25	207.0	63.5	3,588	16
7	4" (80) Cond	Conc Trench	Conc Trench	Lawn	ΓĿ	330	109.2	63.5	15,081	99
ı	5" (40) HPS	Conc Trench	Conc Trench	Conc Trench	LF	44	250.5	73.5	7,788	34
	5" (40) HPS	Conc Trench	Conc Trench	Conc Trench	LF	198	250.5	73.5	35,046	154
	5" (40) HPS	Conc Trench		Conc Road	LF	25	250.5	73.5	4,425	19
	6" (40) HPS	Conc Trench	Conc Trench	Lawn	LF	629	293.5	75.3	148,158	649
Bldg 13 to MH A5	- 1		Trench	Conc Road	LF	38	293.5	75.3	8,292	36
<u>ا</u>	-	<b>MH A9 (Alternative</b>	ative 2)							
	5" (40) HPS	Conc Trench	Conc Trench	Conc Trench	LF	298	250.5	73.5	52,746	231
	5" (40) HPS	Conc Trench		Conc Road	LF	22	250.5	73.5	3,894	17
١	3" (80) Cond	DB Red Brass	Conc Trench	Conc Trench	LF	298	270.4	37.2	69,494	304
	3" (80) Cond	DB Red Brass		Conc Road	F	22	270.4	37.2	5,130	22
MH A9 to Bldg 1	2 1/2" (40) HPS	Conc Trench		Conc Trench	느	100	140.1	52.7	8,740	38
MH A9 to Bidg1	1 1/2" (80) Cond	Conc Trench		Conc Trench	F	140	53.2	29.3	3,346	15
MH A8 to Bldg 2	2" (40) HPS	Conc Trench		Conc Trench	LF	130	120.9	47.3	9,568	42
MH A8 to Bldg 2	1 1/2" (80) Cond	Conc Trench		Conc Trench	LF	130	53.2	29.3	3,107	14
MH A5 to MH A7	5" (40) HPS	Conc Trench		Conc Trench	4	349	250.5	73.5	61,773	271
MH A5 to MH A/	5" (40) HPS	Conc Trench		Conc Road	5	51	250.5	73.5	9,027	40
MH A5 to MH A/		DB Red Brass	Conc Trench	Conc Trench	<u>"</u>	349	270.4	37.2	81,387	356
MH A5 to MH A7	3" (80) Cond	DB Red Brass	Conc Trench	Conc Road	<b>"</b>	21	270.4	37.2	11,893	52

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Thermal Savings for Industrial Area Steam Distribution System Piping Replacements

		Existing	Proposed		Quantity	ntity		i	Thermal Savings	savings
Location	Service	Placement	Placement	Surface	No.	Unit	Current	Proposed	Heat Load	KK BTU/Yr
Pine Reconting for Bldgs 3	or Bldge 2 25	2 26 (Alternative 2)			Onits	Meas.	BIUHILF	BTUH/LF	Saved BTUH	Saved
חכ		- 1	alive 3)							
	2" (40) HPS	Direct Bury	DB Conduit	Lawn	LF	71	120.9	43.3	5,510	24
	2" (40) HPS	Direct Bury	DB Conduit	Conc Road	LF	18	120.9	43.3	1,397	9
-	2" (40) HPS	Direct Bury	DB Conduit	Sidewalk	LF	5	120.9	43.3	388	2
	2" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	7.1	244.9	30.1	15,251	29
	2" (80) Cond	DB Red Brass	DB Conduit	Conc Road	LF.	18	244.9	30.1	3,866	17
Bldg 3 to Bldg 35	2" (80) Cond	DB Red Brass	DB Conduit	Sidewalk	4	5	244.9	30.1	1,074	5
MH A2-1 to MH A2-2 2" (40) HPS	2" (40) HPS	Rerouted Pipe	DB Conduit	Asphalt	LF	185	0.0	43.3	(8,011)	(35)
MH A2-2 to MH A2-3 2" (40) HPS	2" (40) HPS	Rerouted Pipe	DB Conduit	Asphalt	LF	241	0.0	43.3	(10,435)	(46)
MH A2-2 to MH A2-3 2" (40) HPS	2" (40) HPS	Rerouted Pipe	DB Conduit	Conc Road	LF	42	0.0	43.3	(1,819)	(8)
MH A2-1 to MH A2-2 4" (80) Cond	4" (80) Cond	DB Red Brass	DB Conduit	Asphalt	LF	185	290	38.7	46,491	204
MH A2-2 to MH A2-3 3" (80) Cond	3" (80) Cond	DB Red Brass		Asphalt	LF	241	270.4	32.7	57,286	251
MH A2-2 to MH A2-3 3" (80) Cond	3" (80) Cond	DB Red Brass		Conc Road	LF	42	270.4	32.7	9,983	44
Bldg 35 to Bldg 36	2" (40) HPS	Direct Bury	DB Conduit	Conc Road	LF	20	120.9	43.3	1,552	7
Bldg 35 to Bldg 36	2" (80) Cond	DB Red Brass	DB Conduit	Conc Road	LF	20	244.9	30.1	4,296	19
Bldg 35 to Bldg 36	2" (40) HPS	Direct Bury	DB Conduit	Lawn	LF	9/	120.9	43.3	5,898	26
Bldg 35 to Bldg 36	2" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	92	244.9	30.1	16,325	72
Rerouted Existing		Conc Trench	Conc Trench   rerouted, see above	above	LF	267	120.9	0	32,280	141
Steam Pipe Replacements for		U Street - East (Alternative 4	st (Alternati	ve 4)						
MH A9 to MH EJ3	2 1/2" (80) Cond	Rerouted Pipe	Conc Trench	Conc Trench	5	140	0	38.3	(5,362)	(23)
MH A10 to Bldg 42	2" (40) HPS	Conc Trench	Conc Trench	Conc Trench	F	75	120.9	47.3	5,520	24
MH A10 to Bldg 42	2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	LF	75	63.8	33.9	2,243	10
MH A10 to MH A11	4" (40) HPS	Conc Trench	Conc Trench	Conc Trench	LF.	300	207.0	63.5	43,050	189
MH A10 to MH A11	2 1/2" (80) Cond	Rerouted Pipe	Conc Trench	Conc Trench	<b>5</b>	300	0	38.3	(11,490)	(20)
MH A11 to MH A11J 2 1/2" (80) Cond	2 1/2" (80) Cond	Rerouted Pipe	Conc Trench	Conc Trench	<b>Ľ</b>	20	0	38.3	(1992)	(3)
MH A11 to A11-3	2 1/2" (40) LPS	Conc Trench	Trench	Conc Trench	<b>5</b>	350	100.4	37.9	21,875	96
MH A11-3 to P26	2 1/2" (40) LPS	Conc Trench		Conc Trench	<b>"</b>	150	100.4	37.9	9,375	41
MH A11-1 to V	2" (40) LPS	Conc Irench		Conc Trench	<u>"</u>	40	9.98	34	2,104	6
MHr PZ1 to U	2" (40) LPS	Conc Trench	_	Conc Trench	<b>Ľ</b>	9	9.98	34	2,104	O
MH A11-2 to 1	2" (40) LPS	Conc Trench		Conc Trench	5	4	9.98	34	2,104	6
WH P22 10 S	2 1/2" (40) LPS	Conc I rench		Conc Trench	<u>"</u>	40	100.4	37.9	2,500	11
MH A11-3 to K	2 1/2" (40) LPS	Conc Trench		Conc Trench	<b>"</b>	40	100.4	37.9	2,500	11
MH PZ3 to Q	2 1/2" (40) LPS	Conc Trench	Conc Trench	Conc Trench	5	20	100.4	37.9	3,125	14

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# Thermal Savings for Industrial Area Steam Distribution System Piping Replacements

		Existing	Proposed		Qua	Quantity			Thermal	Savings
Location	Service	Placement	Placement	Surface	No.	Unit	Current	Proposed	Heat Load	KK BTU/Yr
					Units	Meas.	BTUH/LF	BTUH/LF	Saved BTUH	Saved
MH P24 to P	2 1/2" (40) LPS	Conc Trench	Conc Trench Conc Trench	Conc Trench	J)	22	100.4	37.9	3,438	15
MH P25 to O	2 1/2" (40) LPS	Conc Trench	Conc Trench Conc Trench	Conc Trench	<u> </u>	40	100.4	37.9	2,500	11
- 1	2 1/2" (40) LPS	Conc Trench	Conc Trench Conc Trench	Conc Trench	Ы	80	100.4	37.9	5,000	22
Ø	2" Brass Cond	DB Red Brass	rerouted, see above	above	님	195	244.9	0	47,756	209
Condensate Pipe	3" Brass Cond	DB Red Brass rerouted,	see	above	H.	806	270.4	0	245,523	1,075
Family Housing	Condensate P	iping Replacement (Alternative	ement (Alte	rnative 5)						
MH A13 to MH A14	1" (80) Cond	Conc Trench	Conc Trench	Conc Trench	F	300	39.9	23.3	4,980	22
MH A13 to MH A14	1" (80) Cond	Conc Trench	Conc Trench	Conc Road	F	19	39.9	23.3	315	-
MH A14 to MH A15	2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	LF	100	63.8	33.9	2,990	13
MH A15 to MH A14	1 1/2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	H	100	53.2	29.3	2,390	10
MH A15 to MH A16	2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	Ł	92	63.8	33.9	2,841	12
MH A17-1 to A16	1" (80) Cond	Conc Trench	Conc Trench	Conc Trench	LF	62	39.9	23.3	1,577	7
MH A17-1 to A16	1 1/2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	LF	92	53.2	29.3	2,271	10
MH A18 to A17-1	1" (80) Cond	Conc Trench	Conc Trench	Conc Trench	LF	330	39.9	23.3	5,478	24
MH A18 to A17-1	1" (80) Cond	Conc Trench	Conc Trench	Conc Road	LF	20	39.9	23.3	332	-
MH A14 to F/179	1 1/2" (80) Cond	Conc Trench		Conc Trench	LF	33	53.2	29.3	789	က
MH A15 to E/178	1 1/2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	F	44	53.2	29.3	1,052	5
MH A16 to D/177	1 1/2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	LF	44	53.2	29.3	1,052	5
MH A17-1 to C/176	1 1/2" (80) Cond	Conc Trench		Conc Trench	F	44	53.2	29.3	1,052	5
MH A17 to B/175	1 1/2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	LF	44	53.2	29.3	1,052	5
MH A18 to A/174	2" (80) Cond	Conc Trench	Conc Trench	Conc Trench	LF	65	63.8	33.9	1,944	6
MH A18 to A/174	2" (80) Cond	Conc Trench	c Trench	Conc Road	H.	15	63.8	33.9	449	2
MH A16 to N-1	2" (80) Cond	DB FRP Pipe	Conduit	Lawn	님	311	221.6	30.1	29,557	261
MH A16 to N-1	2" (80) Cond	DB FRP Pipe	Conduit	Conc Road	5	40	221.6	30.1	099'2	34
MH A16 to N-1	2" (80) Cond		Conduit	Sidewalk	5	2	221.6	30.1	958	4
MH N-1 to DD/291	1 1/2" (80) Cond	씱	Conduit	Lawn	<b>5</b>	35	201.4	26	6,139	27
MH N-1 to N-2	2" (80) Cond		Conduit	Lawn	ዛ	120	221.6	30.1	22,980	101
MH N-1 to N-2	2" (80) Cond	FRP	Conduit	Sidewalk	F	10	221.6	30.1	1,915	∞
MH N-2 to CC/290	1 1/2" (80) Cond	FRP	Conduit	Lawn	LF	32	201.4	26	6,139	27
MH N-2 to N-3	2" (80) Cond	FRP	Conduit	Lawn	ц.	514	221.6	30.1	98,431	431
MH N-2 to N-3	2" (80) Cond	DB FRP Pipe	Conduit	Conc Road	4	20	221.6	30.1	3,830	17
MH N-3 to 292-2	1 1/2" (80) Cond	FRP	Conduit	Lawn	<u>"</u>	40	201.4	26	7,016	31
MH N-3 to N-4	Z" (80) Cond	DB FRP Pipe	DB Conduit 1	Lawn	5	100	221.6	30.1	19,150	84

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# Thermal Savings for Industrial Area Steam Distribution System Piping Replacements

		Existing	Proposed		Quantity	ntity			Thermal Savings	avings
Location	Service	Placement	Placement	Surface	Š	Cuit	Current	Proposed	Heat Load	KK BTU/Yr
					Units	Meas.	<b>BTUH/LF</b>	BTUH/LF	Saved BTUH	Saved
MH N-3 to N-4	2" (80) Cond	DB FRP Pipe	DB Conduit	Conc Road	LF	20	221.6	30.1	3,830	17
MH N-4 to N-5	2" (80) Cond	DB FRP Pipe	DB Conduit	Lawn	LF	362	221.6	30.1	69,323	304
MH N-4 to N-5	2" (80) Cond	DB FRP Pipe	DB Conduit	Conc Road	LF	40	221.6	30.1	7,660	34
MH N-4 to N-5	2" (80) Cond	DB FRP Pipe	DB Conduit	Sidewalk	느	10	221.6	30.1	1,915	8
MH N-5 to N-6	2" (80) Cond	DB FRP Pipe	DB Conduit	Lawn	<b>Ľ</b>	454	221.6	30.1	86,941	381
MH N-5 to N-6	2" (80) Cond	DB FRP Pipe	DB Conduit	Conc Road	4	40	221.6	30.1	7,660	34
Shop Area Condensate Pipin	lensate Piping	Replacements (Alternative 6)	ts (Alternat	ive 6)						
MH A-5 to R5-1	3" (80) Cond	DB Red Brass	DB Conduit	Lawn	1	75	270.4	32.7	17,828	78
MH R5-1 to R5-2	3" (80) Cond	DB Red Brass	DB Conduit	Lawn	L.	105	270.4	32.7	24,959	109
MH R5-1 to R5-2	2" (80) Cond	DB Red Brass	DB Conduit	Sidewalk	LF	5	244.9	30.1	1,074	2
MH R5-1 to Bldg 6	1 1/2" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	15	232.2	56	3,093	14
MH R5-2 to Bldg 6	1 1/2" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	15	232.2	56	3,093	14
MH R5-2 to R5-4	2" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	25	244.9	30.1	5,370	24
MH R5-2 to R5-4	2" (80) Cond	DB Red Brass	DB Conduit	Concrete	LF	138	244.9	30.1	29,642	130
MH R5-4 to Bldg 7	1 1/2" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	15	232.2	56	3,093	14
Bldg 6 to Bldg 7	3" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	20	270.4	32.7	4,754	21
Bldg 6 to Bldg 7	3" (80) Cond	DB Red Brass	DB Conduit	Concrete	LF	25	270.4	32.7	5,943	26
Bidg 7 to Bidg 8	3" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	20	270.4	32.7	11,885	52
	2" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	140	244.9	30.1	30,072	132
ŀ	2" (80) Cond	DB Red Brass		Concrete	님	2	244.9	30.1	430	2
İ	2" (80) Cond	DB Red Brass	DB Conduit	Sidewalk	느	5	244.9	30.1	1,074	5
	2" (80) Cond	DB Red Brass	DB Conduit	Lawn	LF	100	244.9	30.1	21,480	94
	2" (80) Cond	DB Red Brass	DB Conduit	Concrete	LF	30	244.9	30.1	6,444	28
	2" (80) Cond	DB Red Brass	DB Conduit	Lawn	느	50	244.9	30.1	10,740	47
	2" (80) Cond	DB Red Brass		Concrete	F	45	244.9	30.1	999'6	42
- 1	2" (80) Cond	DB Red Brass	DB Conduit	Building	LF	20	244.9	30.1	10,740	47
MH R5-8 to Bldg 11		DB Red Brass	Conduit	Sidewalk	LF	5	232.2	26	1,031	5
MH R5-8 to Bldg 11	1	B R	DB Conduit	Lawn	LF	7	232.2	26	1,443	9
Total of Recommended Alternatives	46	2, 3, 4 and 5								5,809
Boiler Plant Efficiency	,									67.2%
Fuel Oil Savings of Piping Thermal	— 1	Losses (kk BTU/Year)	Year)				İ			8,646

		<del> </del>		Date Pr	enared	Sheet	of
CONSTRUC	TION COS	T ESTIMA	TE	1	- 95	1	11
Project	11014 003	LSTIVIA	<u> </u>	Project		Basis for E	
ECIP Modernize I	ndustrial Area	a Steam Dis	tribution		10667	Duoio ioi L	otimate
Location						<u> </u>	
Hawthorne Arn	ny Ammunitic	n Depot, Ne	evada	Co	de A (no	design co	mpleted)
Engineer-Architect							
Keller & Ganno	n					In	
Drawing No.	om Monholo	AE to Mon	hala AO	Estimat		Checked B	•
Replace Pipes fr	om wannoie	A5 to Man	noie A9	1	IH.	Unit	Total
Location	Service	Placement	Surface	No.	entity Unit	Cost	Cost
				Units	Meas.		
Piping cost						,	
MH A7 to MH A9	5" (40) HPS	Conc Trench	Conc	298	LF	\$65.58	\$19,540
MH A7 to MH A9		Conc Trench		22	LF	\$65.58	\$1,443
MH A7 to MH A9		Conc Trench		298	LF	\$37.91	\$11,298
MH A7 to MH A9		Conc Trench	Conc Road	22	LF	\$37.91	\$834
MH A9 to Bldg 1	2 1/2" (40)	Conc Trench	Conc	100	LF	\$31.26	\$3,126
MH A9 to Bldg1	1 1/2" (80)	Conc Trench	Conc	140	LF	\$37.91	\$5,308
MH A8 to Bldg 2	2" (40) HPS	Conc Trench	Conc	130	LF	\$26.71	\$3,472
MH A8 to Bldg 2	1 1/2" (80)	Conc Trench	Conc	130	LF	\$20.00	\$2,599
MH A5 to MH A7	5" (40) HPS	Conc Trench	Conc	349	LF	\$65.58	\$22,887
MH A5 to MH A7	5" (40) HPS	Conc Trench	Conc Road	51	LF	\$65.58	\$3,345
MH A5 to MH A7		Conc Trench		349	LF	\$37.91	\$13,232
MH A5 to MH A7	3" (80) Cond	Conc Trench	Conc Road	51	LF	\$37.91	\$1,934
						Total =	\$89,020
Demoliition cost size	ze as in para	llel return	line.)				
MH A7 to MH A9	5" (40) HPS	Conc Trench	Conc	298	LF	\$4.69	\$1,398
MH A7 to MH A9	5" (40) HPS	Conc Trench	Conc Road	22	LF	\$4.69	\$103
MH A7 to MH A9	3" (80) Cond	Conc Trench	Conc	298	LF	\$0.00	\$(
MH A7 to MH A9		Conc Trench	Conc Road	22	LF	\$0.00	\$0
MH A9 to Bldg 1	2 1/2" (40)	Conc Trench	Conc	100	LF	\$3.18	\$318
MH A9 to Bldg1	1 1/2" (80)	Conc Trench	Conc	140	LF	\$1.17	\$164
MH A8 to Bldg 2	2" (40) HPS	Conc Trench	Conc	130	LF	\$1.17	\$152
MH A8 to Bldg 2	1 1/2" (80)	Conc Trench	Conc	130	LF	\$0.00	\$0
MH A5 to MH A7	<u> </u>	Conc Trench		349	LF	\$4.69	\$1,637
MH A5 to MH A7		Conc Trench		51	LF	\$4.69	\$239
MH A5 to MH A7		Conc Trench		349	LF	\$0.00	\$0
MH A5 to MH A7	3" (80) Cond	Conc Trench	Conc Road	51	LF	\$0.00	\$0
						Total =	\$4,010
Construction cost							
MH A7 to MH A9		Conc Trench		298	LF	\$3.18	\$947
MH A7 to MH A9	5" (40) HPS	Conc Trench	Conc Road	22	LF	\$17.62	\$388
MH A7 to MH A9	3" (80) Cond	Conc Trench	Conc	298	LF	\$3.18	\$947
MH A7 to MH A9		Conc Trench	Conc Road	22	LF	\$17.62	\$388
MH A9 to Bldg 1	2 1/2" (40)	Conc Trench	Conc	100	LF	\$3.18	\$318
MH A9 to Bldg1	1 1/2" (80)	Conc Trench	Conc	140	LF	\$3.18	\$445
MH A8 to Bldg 2	2" (40) HPS	Conc Trench	Conc	130	LF	\$3.18	\$413
MH A8 to Bldg 2	1 1/2" (80)	Conc Trench	Conc	130	LF	\$3.18	\$413
MH A5 to MH A7		Conc Trench	Conc	349	LF	\$3.18	\$1,109
MH A5 to MH A7		Conc Trench	Conc Road	51	LF	\$17.62	\$899
MH A5 to MH A7	3" (80) Cond	Conc Trench	Conc	349	LF	\$3.18	\$1,109
MH A5 to MH A7	3" (80) Cond	Conc Trench	Conc Road	51	LF	\$17.62	\$899
						Total =	\$8,273

CONSTRUCT	TION COS	TESTIMA		Date Pr	-	Sheet	
Project			TE	Sep	- 95	2	11
ECID Madamina In				Project		Basis for I	
ECIP Wodernize in	ndustrial Area	Steam Dis	tribution		10667		
Location		**********		1		L	
Hawthorne Arm	y Ammunitio	n Depot, Ne	evada	Co	de A (no	design co	ompleted)
Engineer-Architect				1			
Keller & Gannor	n			<u>.</u>			
Drawing No.				Estimate		Checked I	-
Replace Pipes fro	om Manhole	A5 to Man	hole A9		IH		RCL
Location	Candaa	Discourse	0	Qua No.	intity Unit	Unit	Total
Location	Service	Placement	Surface	Units	Meas.	Cost	Cost
Fittings cost				1 5		l	
MH A7	5" (40) HPS '	<u>г'                                    </u>		2	EA	\$416	\$832
	5" (40) HPS ' 4			2	EA	\$296	
	1 1/2" Drip Tra		····	1	EA	\$1,999	
	3" (80) Cond '			2	EA	\$341	\$682
	3" (80) Cond '			1 1	EA	\$158	
MH A8	5" (40) HPS '			2	EA	\$416	
	5" (40) HPS ' 4	15° EL '	1.4.4	2	EA	\$296	
	1 1/2" Drip Tra	ıp Ass.		1	EA	\$1,999	
		1	EA	\$282	\$282		
	3" (80) Cond '			2	EA	\$341	\$682
	3" (80) Cond '			1	EA	\$158	\$158
	2" Cond Valve			1	EA	\$282	\$282
MH A9	5" (40) HPS ' 1			1	EA	\$416	\$416
	2 1/2" HPS Va			1	EA	\$858	\$858
	3" (80) Cond '			1	EA	\$341	\$341
Evannian lainta	1 1/2" Cond Va			1 1	EA	\$217	\$217
Expansion Joints	5" Steam or Co			7	EA	\$724	\$5,066
	4" Steam or Co	ondensate		1	EA	\$575 Total	\$575
Subtotal						Total =	\$16,561
Nevada Sales Tax	3.75%	Danad on a		A T	4	E 40/ I	\$117,863
Subtotal	3.75%	based on a	verage of ma	iteriais d	costs	54%	
Contractor OH & Profit	25.0%						\$120,249
Subtotal	20.076						30,062 \$150,312
Estimating Contingency	10.0%						15,031
Total Probable Construc							\$165,343
Average Cost per Linear F		team and Cor	idensate Pir	ina & Fi	ttings		\$85.23

				Date Pr	enared	Sheet	of
CONSTRUC	TION COST	FSTIMAT	<b>=</b>		95	3	11
Project	11011 0031	LOTIVIAT		Project		Basis for	
ECIP Modernize	Industrial Area	eSteam Die	tribution		40667	Dasis IUI	Estimate
Location	madstrar Arca	30team Dis	uibalion	F1V-	+0007	1	
Hawthorne A	rmy Ammunitior	Depot Ne	vada	Co	de A (no	design co	mpleted)
Engineer-Architect	The state of the s	. Борол, то	7444	┨	uc A (III	o design co	inpieteu)
Keller & Ganno	on						
Drawing No.				Estimat	or	Checked	Ву
Reroute Pi	pes for Buildir	ngs 3, 35 &	36	В	IH	F	RCL
		Ī			antity	Unit	Total
Location	Service	Placement	Surface	No.	Unit	Cost	Cost
Dining cost			1	Units	Meas.	<u></u>	
Piping cost	T 2" (40) LIDO	Discret Discret	T	T =4	=	T 455 55	
Bldg 3 to Bldg 35	2" (40) HPS	Direct Bury	Lawn	71	LF	\$55.50	
Bldg 3 to Bldg 35 Bldg 3 to Bldg 35	2" (40) HPS	Direct Bury	Conc Road	18	LF	\$55.50	
Bldg 3 to Bldg 35	2" (40) HPS	Direct Bury	Sidewalk	5	LF	\$55.50	
Bldg 3 to Bldg 35	2" (80) Cond 2" (80) Cond	Direct Bury	Lawn	71	LF	\$48.67	\$3,456
Bldg 3 to Bldg 35	2" (80) Cond	Direct Bury Direct Bury	Conc Road Sidewalk	18 5	LF	\$48.67	\$876
MH A2-1 to MH A2-2	2" (40) HPS	Direct Bury	Asphalt	185	LF	\$48.67	\$243
MH A2-2 to MH A2-3	2" (40) HPS	Direct Bury	Asphalt	241	LF LF	\$55.50	\$10,267
MH A2-2 to MH A2-3	2" (40) HPS	Direct Bury	Conc Road	42	LF	\$55.50 \$55.50	\$13,374 \$2,331
MH A2-1 to MH A2-2	4" (80) Cond	Direct Bury	Asphalt	185	LF	\$66.75	\$12,349
MH A2-2 to MH A2-3	3" (80) Cond	Direct Bury	Asphalt	241	LF	\$59.70	\$14,388
MH A2-2 to MH A2-3	3" (80) Cond	Direct Bury	Conc Road	42	LF	\$59.70	\$14,366
Through Bldg 3	2" (80) Cond	0	0	60	LF	\$48.67	\$2,920
Through Bldg 35	2" (80) Cond	0	0	135	LF	\$48.67	\$6,570
Bldg 35 to Bldg 36	2" (40) HPS	Direct Bury	Conc Road	20	LF	\$55.50	\$1,110
Bldg 35 to Bldg 36	2" (80) Cond	Direct Bury	Conc Road	20	LF	\$48.67	\$973
Bldg 35 to Bldg 36	2" (40) HPS	Direct Bury	Lawn	76	LF	\$55.50	\$4,218
Bldg 35 to Bldg 36	2" (80) Cond	Direct Bury	Lawn	76	LF	\$48.67	\$3,699
						Total =	\$84,498
Demolition cost E	xistina pipina is	to be aban	doned in pla	ace. q	emolit		
Construction cost	<u> </u>			<del>100, u</del>	OTTION	1011 000	ΨΟ
Bldg 3 to Bldg 35	2" (40) HPS	Direct Bury	Lawn	71	LF	\$4.77	\$339
Bldg 3 to Bldg 35	2" (40) HPS	Direct Bury	Conc Road	18	LF	\$18.02	\$324
Bldg 3 to Bldg 35	2" (40) HPS	Direct Bury	Sidewalk	5	LF	\$12.87	Ψ324 \$64
Bldg 3 to Bldg 35	2" (80) Cond	Direct Bury	Lawn	71	LF	\$4.77	\$339
Bldg 3 to Bldg 35	2" (80) Cond	Direct Bury	Conc Road	18	LF	\$18.02	\$324
Bldg 3 to Bldg 35	2" (80) Cond	Direct Bury	Sidewalk	5	LF	\$12.87	\$64
MH A2-1 to MH A2-2	2" (40) HPS	Direct Bury	Asphalt	185	LF	\$12.87	\$2,380
MH A2-2 to MH A2-3	2" (40) HPS	Direct Bury	Asphait	241	LF	\$12.87	\$3,101
MH A2-2 to MH A2-3	2" (40) HPS	Direct Bury	Conc Road	42	LF	\$18.02	\$757
MH A2-1 to MH A2-2	4" (80) Cond	Direct Bury	Asphalt	185	LF	\$12.87	\$2,380
MH A2-2 to MH A2-3	3" (80) Cond	Direct Bury	Asphalt	241	LF	\$12.87	\$3,101
MH A2-2 to MH A2-3	3" (80) Cond	Direct Bury	Conc Road	42	LF	\$18.02	\$757
Through Bldg 3	2" (80) Cond		-	1	ĒA	\$62.25	\$62
Through Bldg 35	2" (80) Cond	-	-	1	EA	\$62.25	\$62
Bldg 35 to Bldg 36	2" (40) HPS	Direct Bury	Conc Road	20	LF	\$18.02	\$360
Bldg 35 to Bldg 36	2" (80) Cond	Direct Bury	Conc Road	20	LF	\$18.02	\$360
Bldg 35 to Bldg 36	2" (40) HPS	Direct Bury	Lawn	76	LF	\$4.77	\$363
Bldg 35 to Bldg 36	2" (80) Cond	Direct Bury	Lawn	76	LF	\$4.77	\$363
		,				Total =	\$15,502
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				Date Pr	epared	Sheet	of
CONSTRUC	TION COST E	ESTIMATE		Sep	- 95	4	11
Project				Project		Basis for	
ECIP Modernize	Industrial Areas	Steam Dist	ribution	PN-4	10667		
Location						-I-	
Hawthorne A	rmy Ammunition	Depot, Nev	/ada	Co	de A (no	design c	ompleted)
Engineer-Architect				]			
Keller & Ganno	on						
Drawing No.	6 B 11 11			Estimat		Checked	•
Reroute Pi	pes for Buildin	gs 3, 35 & 3	36		IH	<u> </u>	RCL
Location	Service	Placement	Surface	No.	antity Unit	Unit	Total
Location	Service	Placement	Surrace	Units	Meas.	Cost	Cost
Elbow cost			<u> </u>		1	<u> </u>	1
MH A2-1 to MH A2-2	2" (40) HPS ELB	Direct Bury	Asphalt	4	EA	\$276	\$1,103
MH A2-2 to MH A2-3	2" (40) HPS ELB		Asphalt	4	EA	\$276	
MH A2-1 to MH A2-2	3" (80) Cond ELB		Asphalt	4	EA	\$392	
MH A2-2 to MH A2-3	4" (80) Cond ELB	Direct Bury	Asphalt	4	EA	\$456	\$1,824
						Total =	\$5,598
Core Drill cost						1.1	
Through Bldg 3	2" (40) HPS			2	EA	\$351	\$701
Through Bldg 3	2" (80) Cond			2	EA	\$351	
Through Bldg 35	2" (40) HPS			2	EA	\$351	\$701
Through Bldg 35	2" (80) Cond			2	EA	\$351	\$701
						Total =	\$2,806
Fittings cost							
MH A2-2	2" (40) HPS ' T '			2	EA	\$163	\$325
	2" (40) HPS ' 45° E			1	EA	\$121	\$121
	1 1/2" Drip Trap As	SS.		1	EA	\$1,999	\$1,999
	3" (80) Cond ' T '			2	EA	\$247	\$494
	3" (80) Cond ' 90°	EL'		1	EA	\$171	\$171
MULAGO	Anchors			2	EA	\$39	\$78
MH A2-3	2" (40) HPS ' T '			1	EA	\$41	\$41
	2" HPS Valve			1	EA	\$282	\$282
	2" (80) Cond ' T '			1	EA	\$217	\$217
Expansion Joints	2" Cond Valve		1	1	EA	\$282	\$282
Expansion Joints	None Required, Lo	ops are instal	iea			T	\$0
Subtotal						Total =	\$4,010 \$4,010
Nevada Sales Tax	3.75%	Based on av	erage of ma	toriolo c	ooto T	E 40/	\$112,413
Subtotal	0.7070	Dused on al	rerage of fila	CIIAIS (	,U313	54%	\$2,276 \$114,688
Contractor OH & Profit	25.0%						\$28,672
Subtotal	20.0 /0						\$143,360
Estimating Contingency	10.0%						\$14,336
Total Probable Constru				I	I		\$157,696
Average Cost per Linear		m and Conde	nsate Pining	& Fittin	as I	7	\$119.83

CONSTRUCTION COST ESTIMATE					Date F	Prepare	Sheet	of
Project No.	CONSTRUCTION COST ESTIMATE				1		1	
Coration								
Hawthorne Army Ammunition   Depot, Nevada   Regineer-Architect   Keller & Gannon	ECIP Modernize Industrial Area Steam Distribution				1 -		Dasis IVI E	-surrate
Replace Steam Piping - U Street East		my Ammunition	Donot Nov	ada				
Checked By   RCL	Engineer-Architect	my Ammunidor	i Depot, Nev	aua	- Co	de A (no	design co	mpleted)
Checked By Replace Steam Piping - U Street East	1 -	nn						
Replace Steam Piping - U Street East		711		1-10.0	Fetimet	or	Checked	Rv.
Piping cost	1 *	team Piping - l	J Street Eas	st				-
Piping cost							I	
Piping cost	Location	Service	Placement	Surface	1	l .	Cost	Cost
MH A9 to MH EJ3	Piping cost				Units	ivieas.	<u> </u>	-,
MH A10 to Bidg 42		2 1/2" (80) Cond	Conc Trench	Conc	140	TIE	\$32.10	\$4.506
MH A10 to Bidg 42 2" (80) Cond Conc Trench Conc 75 LF \$25.01 \$1,875 MH A10 to MH A11 4" (40) HPS Conc Trench Conc 300 LF \$44.37 \$13,312 MH A10 to MH A11 2 1/2" (80) Cond Conc Trench Conc 300 LF \$44.37 \$13,312 MH A11 to MH A11 2 1/2" (80) Cond Conc Trench Conc 20 LF \$32.19 \$9.657 MH A11 to MH A11 2 1/2" (40) LPS Conc Trench Conc 20 LF \$32.19 \$644 MH A11 to A11-3 2 1/2" (40) LPS Conc Trench Conc 350 LF \$31.26 \$10,940 MH A11-1 to V 2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,0940 MH A11-1 to V 2" (40) LPS Conc Trench Conc 40 LF \$26.71 \$1,068 MH P21 to U 2" (40) LPS Conc Trench Conc 40 LF \$26.71 \$1,068 MH A11-2 to T 2" (40) LPS Conc Trench Conc 40 LF \$26.71 \$1,068 MH A11-3 to R 2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250 MH P23 to Q 2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250 MH P23 to Q 2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250 MH P23 to Q 2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250 MH P25 to MH P25 to D 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,563 MH P25 to D 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,563 MH P25 to D 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,250 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,563 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,250 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,250 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,250 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250 MH P21 to MH P22 To S 2 1/2" (40) LPS Conc Trench Conc 40 LF \$1.56 \$62 MH P21 to MH P22 To S 2 1/2" (40) LPS Conc Trench Conc 40 LF \$1.56 \$62 MH P21 to MH P22 To S 2 1/2" (40) LPS								
MH A10 to MH A11		\ /						
MH A10 to MH A11  2 1/2" (80) Cond Conc Trench Conc 300 LF \$32.19 \$9,657  MH A11 to MH A11J 2 1/2" (80) Cond Conc Trench Conc 20 LF \$32.19 \$9,657  MH A11 to MH A11J 2 1/2" (40) LPS Conc Trench Conc 350 LF \$31.26 \$10,940  MH A11-3 to P26 2 1/2" (40) LPS Conc Trench Conc 150 LF \$31.26 \$1,094  MH A11-3 to P26 2 1/2" (40) LPS Conc Trench Conc 150 LF \$31.26 \$4,688  MH A11-1 to V 2" (40) LPS Conc Trench Conc 40 LF \$26.71 \$1,068  MH A11-2 to T 2" (40) LPS Conc Trench Conc 40 LF \$26.71 \$1,068  MH A11-3 to R 2 1/2" (40) LPS Conc Trench Conc 40 LF \$26.71 \$1,068  MH P22 To S 2 1/2" (40) LPS Conc Trench Conc 40 LF \$331.26 \$1,250  MH P23 to Q 2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250  MH P23 to Q 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,550  MH P25 to O 2 1/2" (40) LPS Conc Trench Conc 55 LF \$31.26 \$1,550  MH P25 to O 2 1/2" (40) LPS Conc Trench Conc 55 LF \$31.26 \$1,250  MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 55 LF \$31.26 \$1,250  MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,250  MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 55 LF \$31.26 \$1,250  MH A10 to MH A11 4" (40) LPS Conc Trench Conc 55 LF \$31.26 \$1,250  MH A10 to Bidg 42 2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,250  MH A10 to MH A11 4" (40) HPS Conc Trench Conc 50 LF \$31.26 \$1,250  MH A10 to MH A11 4" (40) HPS Conc Trench Conc 50 LF \$31.26 \$1,250  MH A10 to MH A11 4" (40) HPS Conc Trench Conc 55 LF \$1.77  S88  MH A11 to MH A11 2 1/2" (80) Cond Conc Trench Conc 75 LF \$1.56 \$117  MH A10 to MH A11 4" (40) HPS Conc Trench Conc 75 LF \$1.56 \$117  MH A10 to MH A11 2 1/2" (80) Cond Conc Trench Conc 100 LF \$1.56 \$468  MH A11 to MH A11 2 1/2" (80) Cond Conc Trench Conc 100 LF \$1.56 \$468  MH A11 to MH A11 2 1/2" (80) Cond Conc Trench Conc 100 LF \$1.56 \$62  MH A11-3 to P26 2 1/2" (40) LPS Conc Trench Conc 40 LF \$1.56 \$62  MH P21 to U 2" (40) LPS Conc Trench Conc 40 LF \$1.56 \$62  MH P21 to U 2" (40) LPS Conc Trench Conc 40 LF \$1.56 \$62  MH P21 to U 2" (40) LPS Conc Trench Conc 50 LF \$1.56 \$62  MH P21 to U 2" (40) LPS Conc								
MH A11 to MH A11J		<u> </u>						
MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         350         LF         \$31.26         \$10,940           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$31.26         \$4,688           MH A11-1 to V         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH P21 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,563           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$31.26         \$1,750           MH P23 to O         2 1/2" (40) LPS </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$31.26         \$4,688           MH A11-1 to V         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P30 To Q         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,250           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$31.26         \$1,749           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,749           MH P25 to MH P26         2 1/2" (4						1		
MH A11-1 to V   2" (40) LPS   Conc Trench   Conc   40   LF   \$26.71   \$1,068   MH P21 to U   2" (40) LPS   Conc Trench   Conc   40   LF   \$26.71   \$1,068   MH A11-2 to T   2" (40) LPS   Conc Trench   Conc   40   LF   \$26.71   \$1,068   MH P22 To S   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$31.26   \$1,250   MH P23 to Q   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$31.26   \$1,250   MH P23 to Q   2 1/2" (40) LPS   Conc Trench   Conc   50   LF   \$31.26   \$1,250   MH P24 to P   2 1/2" (40) LPS   Conc Trench   Conc   55   LF   \$31.26   \$1,250   MH P25 to O   2 1/2" (40) LPS   Conc Trench   Conc   55   LF   \$31.26   \$1,250   MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$31.26   \$1,250   MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$31.26   \$1,250   MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$31.26   \$2,501   Total   \$60,366   MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   80   LF   \$31.26   \$2,501   Total   \$60,366   MH A10 to Bldg 42   2" (40) HPS   Conc Trench   Conc   75   LF   \$1.56   \$117   MH A10 to Bldg 42   2" (80) Cond   Conc Trench   Conc   75   LF   \$1.56   \$117   MH A10 to MH A11   4" (40) HPS   Conc Trench   Conc   300   LF   \$1.56   \$468   MH A10 to MH A11   4" (40) HPS   Conc Trench   Conc   300   LF   \$0.00   \$0   MH A11 to MH A11   2 1/2" (80) Cond   Conc Trench   Conc   350   LF   \$0.00   \$0   MH A11 to MH A11   2 1/2" (80) Cond   Conc Trench   Conc   350   LF   \$1.56   \$346   MH A11-3 to P26   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62   MH A11-3 to P26   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62   MH A11-3 to P2   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62   MH P23 to Q   2 1/2" (40) LPS   Conc Trench   Conc   50   LF   \$1.56   \$62   MH P24 to P   2 1/2" (40) LPS   Conc Trench   Conc   50   LF   \$1.56   \$62   MH P25 to O   2 1/2" (40) LPS   Conc Trench   Conc   50   LF   \$1.56   \$62   MH P25 to O   2 1/2" (40) LPS   Conc Trench   Conc   50   LF   \$		<u> </u>						
MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH A11-2 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH P21 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,563           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,749           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$2,501           Demolition cost (Assumed existing abandoned condensate pipe in trench is the same size as in parallel return line.)           MH A9 to MH E3         2 1/2" (80) Cond Conc Trench         Conc         75         LF         \$0.00         \$0           MH A10 to Bldg 42         2" (80) Cond Conc Trench         Conc         75         LF								
MH A11-2 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$26.71         \$1,068           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,563           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,759           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$2,501           Demolition cost (Assumed existing abandoned condensate pipe in trench           is the same size as in parallel return line.)           Demolition by MH BLJ3         2 1/2" (80) Cond         Conc Trench         Conc         75         LF         \$0.00         \$0           MH A10 to Bidg 4								
MH P22 To S  2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250 MH A11-3 to R  2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,250 MH P23 to Q  2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,250 MH P24 to P  2 1/2" (40) LPS Conc Trench Conc 50 LF \$31.26 \$1,749 MH P25 to O 2 1/2" (40) LPS Conc Trench Conc 55 LF \$31.26 \$1,749 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 40 LF \$31.26 \$1,749 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 80 LF \$31.26 \$1,250 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 80 LF \$31.26 \$1,250 MH P25 to MH P26 2 1/2" (40) LPS Conc Trench Conc 80 LF \$31.26 \$1,250 MH P26								
MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,563           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$31.26         \$1,719           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$31.26         \$2,501           Demolition cost (Assumed existing abandoned condensate pipe in trench is the same size as in parallel return line.)           MH A9 to MH EJ3         2 1/2" (80) Cond Conc Trench         Conc         75         LF         \$1.56         \$117           MH A10 to Bldg 42         2" (80) Cond Conc Trench         Conc         75         LF         \$1.56         \$117           MH A10 to MH A11         4" (40) HPS         Conc Trench         Conc         75         LF         \$1.56         \$468           MH A11 to MH A11.1         2 1/2" (80) Cond         Conc Trench         Conc         300 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$31.26         \$1,563           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$31.26         \$1,719           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$31.26         \$2,501           Demolition cost (Assumed existing abandoned condensate pipe in trench is the same size as in parallel return line.)           MH A9 to MH EJ3         2 1/2" (80) Cond Conc Trench         Conc         140         LF         \$0.00         \$0           MH A10 to Bldg 42         2" (80) Cond Conc Trench         Conc         75         LF         \$1.17         \$88           MH A10 to MH A11         4" (40) HPS         Conc Trench         Conc         75         LF         \$1.17         \$88           MH A11 to MH A11J         2 1/2" (80) Cond         Conc Trench         Conc         300         LF         \$0.00         \$0           MH A11 to A11-3         2 1/2" (40) LPS         Co								
MH P24 to P   2 1/2" (40) LPS   Conc Trench   Conc   55   LF   \$31.26   \$1,719     MH P25 to O   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$31.26   \$1,250     MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   80   LF   \$31.26   \$2,501     Total = \$60,366     Demolition cost (Assumed existing abandoned condensate pipe in trench is the same size as in parallel return line.)  MH A9 to MH EJ3   2 1/2" (80) Cond   Conc Trench   Conc   140   LF   \$0.00   \$0     MH A10 to Bidg 42   2" (40) HPS   Conc Trench   Conc   75   LF   \$1.56   \$117     MH A10 to Bidg 42   2" (80) Cond   Conc Trench   Conc   75   LF   \$1.56   \$468     MH A10 to MH A11   4" (40) HPS   Conc Trench   Conc   300   LF   \$1.56   \$468     MH A10 to MH A11   2 1/2" (80) Cond   Conc Trench   Conc   300   LF   \$0.00   \$0     MH A11 to MH A11   2 1/2" (80) Cond   Conc Trench   Conc   350   LF   \$0.00   \$0     MH A11 to A11-3   2 1/2" (40) LPS   Conc Trench   Conc   350   LF   \$1.56   \$546     MH A11-3 to P26   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62     MH A11-2 to T   2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62     MH A11-3 to R   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62     MH A11-3 to R   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62     MH A11-3 to R   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62     MH P21 to U   2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62     MH P22 To S   2 1/2" (40) LPS   Conc Trench   Conc   40   LF   \$1.56   \$62     MH P23 to Q   2 1/2" (40) LPS   Conc Trench   Conc   55   LF   \$1.56   \$78     MH P24 to P   2 1/2" (40) LPS   Conc Trench   Conc   55   LF   \$1.56   \$86     MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   50   LF   \$1.56   \$86     MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   60   LF   \$1.56   \$86     MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   60   LF   \$1.56   \$86     MH P25 to MH P26   2 1/2" (40) LPS   Conc Trench   Conc   60   LF   \$1.56   \$125     MH P25 to MH P2								
MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$31.26         \$1,250           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$31.26         \$2,501           Demolition cost (Assumed existing abandoned condensate pipe in trench is the same size as in parallel return line.)           MH A9 to MH EJ3         2 1/2" (80) Cond         Conc Trench         Conc         140         LF         \$0.00         \$0           MH A10 to Bidg 42         2" (40) HPS         Conc Trench         Conc         75         LF         \$1.56         \$117           MH A10 to Bidg 42         2" (80) Cond         Conc Trench         Conc         75         LF         \$1.17         \$88           MH A10 to MH A11         4" (40) HPS         Conc Trench         Conc         300         LF         \$1.56         \$468           MH A11 to MH A11J         2 1/2" (80) Cond         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11-1 to V         2" (40) LPS         Conc Trench         Conc </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$31.26         \$2,501           Demolition cost (Assumed existing abandoned condensate pipe in trench is the same size as in parallel return line.)           MH A9 to MH EJ3         2 1/2" (80) Cond         Conc Trench         Conc         140         LF         \$0.00         \$0           MH A10 to Bldg 42         2" (80) Cond         Conc Trench         Conc         75         LF         \$1.56         \$117           MH A10 to MH A11         4" (40) HPS         Conc Trench         Conc         75         LF         \$1.56         \$468           MH A10 to MH A11         2 1/2" (80) Cond         Conc Trench         Conc         300         LF         \$0.00         \$0           MH A11 to MH A11         2 1/2" (80) Cond         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$234								
Demolition cost (Assumed existing abandoned condensate pipe in trench is the same size as in parallel return line.)    MH A9 to MH EJ3								
Step	MIN P25 to MIN P26	2 1/2" (40) LPS	Conc Trench	Conc	80	LF		
Sthe same size as in parallel return line.	D. 1111 ( //							\$60,366
MH A9 to MH EJ3         2 1/2" (80) Cond         Conc Trench         Conc         140         LF         \$0.00         \$0           MH A10 to Bldg 42         2" (40) HPS         Conc Trench         Conc         75         LF         \$1.56         \$117           MH A10 to Bldg 42         2" (80) Cond         Conc Trench         Conc         75         LF         \$1.17         \$88           MH A10 to MH A11         4" (40) HPS         Conc Trench         Conc         300         LF         \$1.56         \$468           MH A11 to MH A11         2 1/2" (80) Cond         Conc Trench         Conc         300         LF         \$0.00         \$0           MH A11 to MH A11J         2 1/2" (80) Cond         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         20         LF         \$1.56         \$546           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$234           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 to T         2 1/2" (40) LPS </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>pipe</td> <td>in trend</td> <td>:h</td>						pipe	in trend	:h
MH A10 to Bldg 42         2" (40) HPS         Conc Trench         Conc         75         LF         \$1.56         \$117           MH A10 to Bldg 42         2" (80) Cond         Conc Trench         Conc         75         LF         \$1.17         \$88           MH A10 to MH A11         4" (40) HPS         Conc Trench         Conc         300         LF         \$1.56         \$468           MH A10 to MH A11         2 1/2" (80) Cond         Conc Trench         Conc         300         LF         \$0.00         \$0           MH A11 to MH A11J         2 1/2" (80) Cond         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         350         LF         \$1.56         \$546           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$62           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS		the same size	as in parall	el return l				
MH A10 to Bidg 42         2" (80) Cond         Conc Trench         Conc         75         LF         \$1.17         \$88           MH A10 to MH A11         4" (40) HPS         Conc Trench         Conc         300         LF         \$1.56         \$468           MH A10 to MH A11         2 1/2" (80) Cond         Conc Trench         Conc         300         LF         \$0.00         \$0           MH A11 to MH A11J         2 1/2" (80) Cond         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         350         LF         \$1.56         \$546           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$234           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
MH A10 to MH A11         4" (40) HPS         Conc Trench         Conc         300         LF         \$1.56         \$468           MH A10 to MH A11         2 1/2" (80) Cond         Conc Trench         Conc         300         LF         \$0.00         \$0           MH A11 to MH A11J         2 1/2" (80) Cond         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         350         LF         \$1.56         \$546           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$234           MH A11-1 to V         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 to T         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P24 to P         2 1/2" (40) LPS								
MH A10 to MH A11         2 1/2" (80) Cond         Conc Trench         Conc         300         LF         \$0.00         \$0           MH A11 to MH A11J         2 1/2" (80) Cond         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         350         LF         \$1.56         \$546           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$234           MH A11-1 to V         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P21 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         C								
MH A11 to MH A11J         2 1/2" (80) Cond         Conc Trench         Conc         20         LF         \$0.00         \$0           MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         350         LF         \$1.56         \$546           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$234           MH A11-1 to V         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-2 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P25 to OH         2 1/2" (40) LPS         Conc						1		
MH A11 to A11-3         2 1/2" (40) LPS         Conc Trench         Conc         350         LF         \$1.56         \$546           MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$234           MH A11-1 to V         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-2 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$1.56         \$86           MH P25 to MH P26         2 1/2" (40) LPS         Conc T								
MH A11-3 to P26         2 1/2" (40) LPS         Conc Trench         Conc         150         LF         \$1.56         \$234           MH A11-1 to V         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-2 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$1.56         \$86           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$1.56         \$125								
MH A11-1 to V         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-2 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$1.56         \$86           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$1.56         \$125								
MH P21 to U         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-2 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$1.56         \$86           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$1.56         \$125								
MH A11-2 to T         2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$1.56         \$86           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$1.56         \$125								
MH P22 To S         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$1.56         \$86           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$1.56         \$125								
MH A11-3 to R         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P23 to Q         2 1/2" (40) LPS         Conc Trench         Conc         50         LF         \$1.56         \$78           MH P24 to P         2 1/2" (40) LPS         Conc Trench         Conc         55         LF         \$1.56         \$86           MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$1.56         \$125								
MH P23 to Q       2 1/2" (40) LPS       Conc Trench       Conc       50       LF       \$1.56       \$78         MH P24 to P       2 1/2" (40) LPS       Conc Trench       Conc       55       LF       \$1.56       \$86         MH P25 to O       2 1/2" (40) LPS       Conc Trench       Conc       40       LF       \$1.56       \$62         MH P25 to MH P26       2 1/2" (40) LPS       Conc Trench       Conc       80       LF       \$1.56       \$125								
MH P24 to P       2 1/2" (40) LPS       Conc Trench       Conc       55       LF       \$1.56       \$86         MH P25 to O       2 1/2" (40) LPS       Conc Trench       Conc       40       LF       \$1.56       \$62         MH P25 to MH P26       2 1/2" (40) LPS       Conc Trench       Conc       80       LF       \$1.56       \$125							\$1.56	\$62
MH P25 to O         2 1/2" (40) LPS         Conc Trench         Conc         40         LF         \$1.56         \$62           MH P25 to MH P26         2 1/2" (40) LPS         Conc Trench         Conc         80         LF         \$1.56         \$125							\$1.56	\$78
MH P25 to MH P26				Conc	55	LF	\$1.56	\$86
( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )				Conc	40	LF	\$1.56	\$62
	MH P25 to MH P26	2 1/2" (40) LPS	Conc Trench	Conc	80	LF	\$1.56	\$125
							Total =	\$2,116

			y	Date F	repare	Sheet	of
CONSTRUCTION COST ESTIMATE				Sep - 95		6	11
				Project No. B		Basis for Estimate	
ECIP Modernize Industrial Area Steam Distribution				PN-4	10667		
Hawthorne Ar	my Ammunition	Depot, Neva	ada	Co	de A (no	design cor	npleted)
Engineer-Architect							
Keller & Ganno	n		······································	France		IO	
Drawing No.  Replace S	team Piping - l	J Street Eas	t	Estimate	or IH	Checked B	y CL
		1		1	ntity	Unit	Total
Location	Service	Placement	Surface	No. Units	Únit Meas.	Cost	Cost
Construction cost							
MH A9 to MH EJ3	2 1/2" (80) Cond	Conc Trench	Conc	140	LF	\$3.18	\$445
MH A10 to Bldg 42	2" (40) HPS	Conc Trench	Conc	75	LF	\$3.18	\$238
MH A10 to Bldg 42	2" (80) Cond	Conc Trench	Conc	75	LF	\$3.18	\$238
MH A10 to MH A11	4" (40) HPS	Conc Trench	Conc	300	LF	\$3.18	\$953
MH A10 to MH A11	2 1/2" (80) Cond		Conc	300	LF	\$3.18	\$953
MH A11 to MH A11J	2 1/2" (80) Cond	Conc Trench	Conc	20	LF	\$3.18	\$64
MH A11 to A11-3	2 1/2" (40) LPS	Conc Trench	Conc	350	LF	\$3.18	\$1,112
MH A11-3 to P26	2 1/2" (40) LPS	Conc Trench	Conc	150	LF	\$3.18	\$477
MH A11-1 to V	2" (40) LPS	Conc Trench	Conc	40	LF	\$3.18	\$127
MH P21 to U	2" (40) LPS	Conc Trench	Conc	40	LF	\$3.18	\$127
MH A11-2 to T	2" (40) LPS	Conc Trench	Conc	40	LF	\$3.18	\$127
MH P22 To S	2 1/2" (40) LPS		Conc	40	LF	\$3.18	\$127
MH A11-3 to R	2 1/2" (40) LPS		Conc	40	LF	\$3.18	\$127
MH P23 to Q	2 1/2" (40) LPS	Conc Trench	Conc	50	LF	\$3.18	\$159
MH P24 to P	2 1/2" (40) LPS	Conc Trench	Conc	55	LF	\$3.18	\$175
MH P25 to O	2 1/2" (40) LPS	Conc Trench	Conc	40	LF	\$3.18	\$127
MH P25 to MH P26	2 1/2" (40) LPS	Conc Trench	Conc	80	LF	\$3.18	\$254
WITT 20 to WITT 20	2 112 (40) 21 0	Cone Trenen	00110	00	LI	Total =	\$5,830
Fittings cost						<u> </u>	
MH A10	4"(40) HPS ' T '			2	EA	\$286	\$572
	4"(40) HPS ' 45° E	EL'		2	EA	\$206	\$412
	1 1/2" Drip Trap A	ISS.		1	EA	\$1,999	\$1,999
	2" HPS Valve			1	EA	\$282	\$282
	2 1/2" (80) Cond '	T		2	EA	\$217	\$435
Company Company	2 1/2" (80) Cond '		×	1	EA	\$153	\$153
0.79	2" Cond Valve			1	EA	\$282	\$282
MH A11	6"(40) HPS ' 45° E	EL'		2	EA	\$206	\$412
	6"(40) HPS Guide			1	EA	\$155	\$155
	6" HPS Valve			1	EA	\$1,742	\$1,742
	8" (40) HPS ' T '			2	EA	\$2,627	\$5,253
	8" (40) HPS ' Guid	de '		1	EA	\$293	\$293
	Anchor			1	EA	\$47	<del>Ψ233</del> \$47
	8" HPS Valve			1	EA	\$2,627	\$2,627
	1 1/2" Drip Trap A	99		1	EA	\$1,999	\$1,999
	1 1/2" (80) Cond '			5		\$110	
	3" (80) Cond ' 90°				EA	\$174	\$551
	<u> </u>			1	EA		\$174
	3" (80) Cond ' Gui	ue		1	EA	\$92	\$92
	3" Cond Valve			1 1	EA	\$874	\$874
	4" (80) Cond ' T '	a a T		2	EA	\$336	\$673
	4" (80) Cond ' Gui	ae		1	EA	\$155	\$155
	Anchor			1	EA	\$43	\$43
4" Cond Valve				1	EA	\$1,132	\$1,132

				Date F	repare	Sheet	of
CONSTRUCTION COST ESTIMATE				1	- 95	7	11
				Project No.		Basis for Estimate	
ECIP Modernize Industrial Area Steam Distribution				PN-40667			
Location						•	<u></u>
Hawthorne A	rmy Ammunition	Depot, Nev	/ada	Co	de A (no	design co	mpleted)
Engineer-Architect							
Keller & Ganno Drawing No.	on			Fatimat		100 0	
1 -	team Piping - L	I Stroot Ea	<b>~</b> +	Estimate	or IH	Checked	By RCL
Teplace o	Team riping - C	Juleet La	<b>5</b> L	<u> </u>	ntity	Unit	Total
Location	Service	Placement	Surface	No.	Unit	Cost	Cost
				Units	Meas.		
MH A11-1	3" (40) LPS ' T '			1	EA	\$341	
	3" (40) LPS ' 45° E			1	EA	\$157	<u> </u>
	1 1/2" Drip Trap A	SS.		1	EA	\$1,999	
MIL DO4	2" LPS Valve			1	EA	\$282	\$282
MH P21	3" (40) LPS ' T '	-, ,		1	EA	\$341	\$341
***	3" (40) LPS ' 45° E 2" LPS Valve	<u> </u>		1	EA	\$157	\$157
MH A11-2	3" (40) LPS 'T'			1	EA	\$282	\$282
IVITI AT 1-2	3" (40) LPS ' 45° E	=		1	EA	\$341 \$157	\$341
	2" LPS Valve			1	EA EA	\$282	\$157
MH P22	3" (40) LPS ' T '			1	EA	\$341	\$282 \$341
14011 22	3" (40) LPS ' 45° EL '			1	EA	\$157	\$157
	2 1/2" LPS Valve	<b></b>		1	EA	\$858	\$858
MH A11-3	3" (40) LPS ' T '			1	EA	\$341	\$341
	3" (40) LPS ' 45° E	EL'		1	EA	\$157	\$157
	2 1/2" LPS Valve			1	EA	\$858	\$858
MH P23	3" (40) LPS ' T '			1	ΕA	\$341	\$341
	3" (40) LPS ' 45° EL '			1	EA	\$157	\$157
	2 1/2" LPS Valve			1	EA	\$858	\$858
MH P24	3" (40) LPS ' T '			1	EΑ	\$341	\$341
	3" (40) LPS ' 45° EL '			1	EA	\$157	\$157
	2 1/2" LPS Valve			1	EA	\$858	\$858
MH P25	3" (40) LPS ' T '			1	EA	\$341	\$341
	3" (40) LPS ' 45° E	L'		1	EA	\$157	\$157
MILDOC	2 1/2" LPS Valve			1	EA	\$858	
MH P26	3" (40) LPS ' T ' 3" (40) LPS ' 45° E	-1 +		1	EA	\$341	\$341
	2 1/2" LPS Valve	<u>L</u>		1	EA	\$157	\$157 \$050
Expansion Joints	6" Steam or Conde	encato		1	EA EA	\$858 \$748	\$858
Expansion coints	5" Steam or Conde			2	EA	\$746 \$724	\$748 \$1,448
	4" Steam or Conde			7	EA	\$575	\$4,028
	3" Steam or Conde			11	EA	\$481	\$5,291
		31.00.0		<u>'''</u>		Total =	\$44,341
Subtotal			***************************************		·····	. Otal	
Nevada Sales Tax	3.75%	Based on a	verage of ma	terials o	osts T	54%	<b>\$112,653</b> \$2,280
Subtotal	0.1070	20000 011 0	. crage of ma	ionais C	,0313	J-7 /0	\$114,933
Contractor OH & Profit						\$28,733	
Subtotal						\$143,666	
Estimating Contingency							\$14,367
Total Probable Constru							\$158,033
Average Cost per Linear	Foot Including Stea	m and Conde	nsate Piping	& Fittin	as		\$86.12

				Date Pr	epared	Sheet	of	
CONSTRUCTION COST ESTIMATE				1	- 95	8	11	
				<u> </u>		Basis for Estimate		
ECIP Modernize Industrial Area Steam Distribution					40667			
Location		_			·	•		
	my Ammunition	Depot, Nev	/ada	Co	de A (no	design co	mpleted)	
Engineer-Architect	_							
Keller & Ganno Drawing No.	)N			Cational		IChlu- d	D	
1 -	ily Housing Co	ndanesta E	Pines	Estimat	or IH	Checked	RCL	
iteplace i alli	ily riousing co	iluelisate r	ipes	1	antity	Unit	Total	
Location	Service	Placement	Surface	No.	Unit	Cost	Cost	
	<u></u>			Units	Meas.		<u> </u>	
Piping cost								
MH A13 to MH A14	1" (80) Cond	Conc Trench		300	LF	\$18.20	\$5,461	
MH A13 to MH A14	1" (80) Cond	Conc Trench		19	LF	\$18.20	\$346	
MH A14 to MH A15	2" (80) Cond	Conc Trench	Conc	100	LF	\$25.01	\$2,501	
MH A15 to MH A14	1 1/2" (80) Cond			100	LF	\$20.00	\$2,000	
MH A15 to MH A16	2" (80) Cond	Conc Trench		95	LF	\$25.01	\$2,376	
MH A17-1 to A16	1" (80) Cond	Conc Trench		95	LF	\$18.20	\$1,729	
MH A17-1 to A16	1 1/2" (80) Cond		Conc	95	LF	\$20.00	\$1,900	
MH A18 to A17-1	1" (80) Cond	Conc Trench	Conc	330	LF	\$18.20	\$6,007	
MH A18 to A17-1	1" (80) Cond	Conc Trench	Conc Road	20	LF	\$18.20	\$364	
MH A14 to F/179		Conc Trench	Conc	33	LF	\$20.00	\$660	
MH A15 to E/178		Conc Trench	Conc	44	LF	\$20.00	\$880	
MH A16 to D/177		Conc Trench	Conc	44	LF	\$20.00	\$880	
MH A17-1 to C/176		Conc Trench	Conc	44	LF	\$20.00	\$880	
MH A17 to B/175		Conc Trench	Conc	44	LF	\$20.00	\$880	
MH A18 to A/174	2" (80) Cond	Conc Trench	Conc	65	LF	\$25.01	\$1,625	
MH A18 to A/174	2" (80) Cond	Conc Trench	Conc Road	15	LF	\$25.01	\$375	
MH A16 to N-1	2" (80) Cond	Direct Bury	Lawn	311	LF	\$48.67	\$15,136	
MH A16 to N-1	2" (80) Cond	Direct Bury	Conc Road	40	LF	\$48.67	\$1,947	
MH A16 to N-1	2" (80) Cond	Direct Bury	Sidewalk	5	LF	\$48.67	\$243	
MH N-1 to DD/291	1 1/2" (80) Cond	Direct Bury	Lawn	35	LF	\$48.34	\$1,692	
MH N-1 to N-2	2" (80) Cond	Direct Bury	Lawn	120	LF	\$48.67	\$5,840	
MH N-1 to N-2	2" (80) Cond	Direct Bury	Sidewalk	10	LF	\$48.67	\$487	
MH N-2 to CC/290	1 1/2" (80) Cond	Direct Bury	Lawn	35	LF	\$48.34	\$1,692	
MH N-2 to N-3	2" (80) Cond	Direct Bury	Lawn	514	LF	\$48.67	\$25,016	
MH N-2 to N-3	2" (80) Cond	Direct Bury	Conc Road	20	LF	\$48.67	\$973	
MH N-3 to 292-2	1 1/2" (80) Cond	Direct Bury	Lawn	40	LF	\$48.34	\$1,934	
MH N-3 to N-4	2" (80) Cond	Direct Bury	Lawn	100	LF	\$48.67	\$4,867	
MH N-3 to N-4	2" (80) Cond	Direct Bury	Conc Road	20	LF	\$48.67	\$973	
MH N-4 to N-5	2" (80) Cond	Direct Bury	Lawn	362	LF	\$48.67	\$17,619	
MH N-4 to N-5	2" (80) Cond	Direct Bury	Conc Road	40	LF	\$48.67	\$1,947	
MH N-4 to N-5	2" (80) Cond	Direct Bury	Sidewalk	10	LF	\$48.67	\$487	
MH N-5 to N-6	2" (80) Cond	Direct Bury	Lawn	454	LF	\$48.67	\$22,096	
MH N-5 to N-6	2" (80) Cond	Direct Bury	Conc Road	40	LF	\$48.67	\$1,947	
<b>5</b> 1141 4 4 4 <b>6</b>						Total =	\$133,759	
Demolition cost (Assumed existing abandoned condensate pipe in trench is the same size as in parallel return line.)								
MH A13 to MH A14   1" (80) Cond   Conc Trench   Conc   300   LF   \$1.17   \$351								
MH A15 to MH A14	1 1/2" (80) Cond		Conc	100	LF	\$1.17	\$117	
MH A15 to MH A16	2" (80) Cond	Conc Trench	Conc	95	LF	\$1.17	\$111	
MH A17-1 to A16	1" (80) Cond	Conc Trench	Conc	95	LF	\$1.17	\$111	
MH A17-1 to A16	1 1/2" (80) Cond		Conc	95	LF	\$1.17	\$111	
MH A18 to A17-1	1" (80) Cond	Conc Trench	Conc	330	LF	\$1.17	\$386	
		- 22		555		Ψ1.17	Ψυσο	

				Date Pr	epared	Sheet	of
CONSTRUCTION COST ESTIMATE					) - 95	9	11
				Project		Basis for B	
	ECIP Modernize Industrial Area Steam Distribution			1	40667	Dusis for t	_Stirriate
Location				'''	.0001	1	
Hawthorne Ar	my Ammunition	Depot. Ne	vada	Co	de A (no	design co	mpleted)
Engineer-Architect	,	ороз,		"	2071 (110	design oc	inpictou)
Keller & Ganno	n						
Drawing No.				Estimat	or	Checked I	Зу
Replace Fami	ily Housing Co	ndensate F	Pipes	В	IH	F	RCL
					antity	Unit	Total
Location	Service	Placement	Surface	No.	Unit	Cost	Cost
MH A18 to A17-1	1" (80) Cond	Conc Trench	Conc Road	Units 20	Meas.	\$1.17	\$23
MH A14 to F/179		Conc Trench		33	LF	\$1.17	\$39
MH A15 to E/178		Conc Trench		44	LF	\$1.17	აა \$51
MH A16 to D/177		Conc Trench		44	LF	\$1.17	\$51
MH A17-1 to C/176		Conc Trench		44	LF	\$1.17	\$51
MH A17 to B/175	<u> </u>	Conc Trench	<u> </u>	44	LF	\$1.17	\$51
MH A18 to A/174	2" (80) Cond	Conc Trench		65	LF	\$1.17	\$76
MH A18 to A/174	2" (80) Cond	Conc Trench		15	LF	\$1.17	\$18
	,, -				<del></del>	Total =	\$1,549
Construction total	cost		I—————————————————————————————————————	!	I	1	<b>V</b> 1,0 10
MH A13 to MH A14	1" (80) Cond	Conc Trench	Conc	300	LF	\$3.18	\$953
MH A13 to MH A14	1" (80) Cond	Conc Trench		19	LF	\$17.62	\$335
MH A14 to MH A15	2" (80) Cond	Conc Trench		100	LF	\$3.18	\$318
MH A15 to MH A14	1 1/2" (80) Cond			100	LF	\$3.18	\$318
MH A15 to MH A16	2" (80) Cond	Conc Trench		95	LF	\$3.18	\$302
MH A17-1 to A16	1" (80) Cond	Conc Trench		95	LF	\$3.18	\$302
MH A17-1 to A16	1 1/2" (80) Cond			95	LF	\$3.18	\$302
MH A18 to A17-1	1" (80) Cond	Conc Trench		330	LF	\$3.18	\$1,048
MH A18 to A17-1	1" (80) Cond	Conc Trench		20	LF	\$17.62	\$352
MH A14 to F/179	1 1/2" (80) Cond		Conc	33	LF	\$3.18	\$105
MH A15 to E/178	1 1/2" (80) Cond	Conc Trench	Conc	44	LF	\$3.18	\$140
MH A16 to D/177	1 1/2" (80) Cond	Conc Trench	Conc	44	LF	\$3.18	\$140
MH A17-1 to C/176	1 1/2" (80) Cond			44	LF	\$3.18	\$140
MH A17 to B/175	1 1/2" (80) Cond	Conc Trench	Conc	44	LF	\$3.18	\$140
MH A18 to A/174	2" (80) Cond	Conc Trench	Conc	65	LF	\$3.18	\$207
MH A18 to A/174	2" (80) Cond	Conc Trench	Conc Road	15	LF	\$17.62	\$264
MH A16 to N-1	2" (80) Cond	Direct Bury	Lawn	311	LF	\$4.77	\$1,483
MH A16 to N-1	2" (80) Cond	Direct Bury	Conc Road	40	LF	\$18.02	\$721
MH A16 to N-1	2" (80) Cond	Direct Bury	Sidewalk	5	LF	\$12.87	\$64
MH N-1 to DD/291	1 1/2" (80) Cond	Direct Bury	Lawn	35	LF	\$4.77	\$167
MH N-1 to N-2	2" (80) Cond	Direct Bury	Lawn	120	LF	\$4.77	\$572
MH N-1 to N-2	2" (80) Cond	Direct Bury	Sidewalk	10	LF	\$12.87	\$129
MH N-2 to CC/290	1 1/2" (80) Cond	Direct Bury	Lawn	35	LF	\$4.77	\$167
MH N-2 to N-3	2" (80) Cond	Direct Bury	Lawn	514	LF	\$4.77	\$2,452
MH N-2 to N-3	2" (80) Cond	Direct Bury	Conc Road	20	LF	\$18.02	\$360
MH N-3 to 292-2	1 1/2" (80) Cond	Direct Bury	Lawn	40	LF	\$4.77	\$191
MH N-3 to N-4	2" (80) Cond	Direct Bury	Lawn	100	LF	\$4.77	\$477
MH N-3 to N-4	2" (80) Cond	Direct Bury	Conc Road	20	LF	\$18.02	\$360
MH N-4 to N-5	2" (80) Cond	Direct Bury	Lawn	362	LF	\$4.77	\$1,727
MH N-4 to N-5	2" (80) Cond	Direct Bury	Conc Road	40	LF	\$18.02	\$721
MH N-4 to N-5	2" (80) Cond	Direct Bury	Sidewalk	10	LF	\$12.87	\$129
MH N-5 to N-6	2" (80) Cond	Direct Bury	Lawn	454	LF	\$4.77	\$2,166
MH N-5 to N-6	2" (80) Cond	Direct Bury	Conc Road	40	LF	\$18.02	\$721
						Total =	\$11,120

				Date Pr	epared	Sheet	of
CONSTRUCTION COST ESTIMATE				1	- 95	10	11
Project				Project No.		Basis for Estimate	
ECIP Modernize Industrial Area Steam Distribution				PN-	40667		
Location						<u> </u>	
	Army Ammunition	n Depot, Nev	ada	_ C₀	de A (no	design co	mpleted)
Engineer-Architect				1			
Keller & Ganr	non			-		To:	
1 7	nily Housing Co	ndonesto D	ince	Estimat	or I <b>H</b>	Checked E	iy RCL
itcpiace i ai	illy flousing co	Tidelisate F	ihea		antity	Unit	Total
Location	Service	Placement	Surface	No.	Unit	Cost	Cost
			******	Units	Meas.		
Elbow cost							
MH A16 to N-1	2" (80) Cond	Direct Bury	Lawn	4	EA	\$322	\$1,287
MH N-1 to N-2	2" (80) Cond	Direct Bury	Lawn	4	EA	\$322	\$1,287
MH N-2 to N-3	2" (80) Cond	Direct Bury	Lawn	8	EA	\$322	\$2,574
MH N-4 to N-5	2" (80) Cond	Direct Bury	Lawn	8	EA	\$322	\$2,574
MH N-5 to N-6	2" (80) Cond	Direct Bury	Lawn	4	EA	\$322	\$1,287
						Total =	\$9,009
Manhole cost							
N-1				1	EA	\$6,266	\$6,266
N-2				1	EA	\$6,266	\$6,266
N-3				1	EA	\$6,266	\$6,266
N-4				1	EA	\$6,266	\$6,266
N-5				1	EA	\$6,266	\$6,266
N-6				1	EA	\$6,266	\$6,266
			······································			Total =	\$37,596
Fittings cost							
MH A13	1" Cond (80) ' T '			2	EA	\$124	\$249
	1" Cond (80) ' 90°	EL'		1	EA	\$97	\$97
	2" Cond Valve			1	EA	\$282	\$282
MH A14	2" Cond (80) ' T '			2	EΑ	\$181	\$362
	2" Cond (80) ' 90°			1	EA	\$135	\$135
	1 1/2" Cond Valve	•		1	EA	\$217	\$217
MH A15	2" Cond (80) ' T '			1	EA	\$181	\$181
1411.440	1 1/2" Cond Valve			1	EA	\$217	\$217
MH A16	1 1/2" (80) Cond '			2	EA	\$151	\$301
NALL A 4.7	1 1/2" Cond Valve	)		1	EA	\$217	\$217
MH A17	1" Cond (80) ' T '			1	EA	\$124	\$124
	1" Cond (80) ' 90°			1	EA	\$97	\$97
NALL A 4 O	1 1/2" Cond Valve			1	EA	\$217	\$217
MH A18	1" Cond (80) ' 90°	EL.		1	EA	\$97	\$97
MH A16 to N-1	2" Cond Valve	FI 1		1	EA	\$282	\$282
IVIT A 10 to IV-1	2" (80) Cond ' 90°	EL.		1	EA	\$135	\$135
MH N-1	Anchors 2" Cond (80) ' T '			2	EA	\$35	\$69
IVITI IN-I		<u> </u>		2	EA	\$181	\$362
	2" (80) Cond ' 90° Anchors	CL.		1	EA	\$135	\$135
	1 1/2" Cond Valve			1	EA	\$35	\$35
MH N-2	2" Cond (80) ' T '			1	EA	\$217	\$217
IVII I IV-Z	Anchors			1	EA	\$181	\$181
	1 1/2" Cond Valve			2	EA	\$35	\$69
MH N-2 to N-3	2" (80) Cond ' 90°			1	EA	\$217	\$217
1711 TA Z 10 14-0	Anchors	<u></u>		4 2	EΑ	\$135	\$540
	AHOHOIS				EA	\$35	\$69

				Date Pro	epared	Sheet	of
CONSTRUCTION COST ESTIMATE				Sep	- 95	11	11
Project	Project				Project No.		Estimate
ECIP Modernize	Industrial Area	Steam Distr	ibution	PN-4	10667		
Location							
Hawthorne Ar	my Ammunition	Depot, Nev	/ada	Co	de A (no	design co	mpleted)
Engineer-Architect Keller & Ganno	_						
Drawing No.	71			Cation at		IObs also d	<u> </u>
	ily Housing Co	ndonasta D	lings	Estimate		Checked	•
ivehiace i aiii	Trousing Col	iuensate r	ipes		IH.	1	RCL
Location	Service	Placement	Surface	No.	entity I Unit	Unit Cost	Total Cost
		1 12001110111	Gundoc	Units	Meas.	0031	0031
MH N-3	2" Cond (80) ' T '			2	EA	\$181	\$362
	2" (80) Cond ' 90°	EL'		1	EA	\$135	\$135
	Anchors			1	EA	\$35	
	2" Cond Valve			1	EA	\$282	\$282
MH N-4	2" Cond (80) ' T '			2	EA	\$181	\$362
	Anchors			1	EA	\$35	\$35
	2" Cond Valve			2	EA	\$282	\$564
MH N-4 to MH N-5	Anchors			2	EA	\$35	\$69
Mh N-5	2" Cond (80) ' T '			1	EA	\$181	\$181
	Anchors			2	EA	\$35	\$69
	2" Cond Valve			1	EA	\$282	\$282
MH N-6	2" Cond (80) ' T '			2	EA	\$181	\$362
	2" (80) Cond ' 90° EL '				EA	\$135	
	Anchors			1	EA	\$35	\$35
Expansion Joints	None Required, Lo	oops are insta	lled				\$0
						Total =	\$8,007
Subtotal	1						6004.044
Nevada Sales Tax	3.75%	Based on a	vorage of ma	torials :	200fc	E 407	\$201,041
Subtotal	3.73%	Dased Off a	verage of ma	teriais (	วบรเธ	54%	
Contractor OH & Profit	25.0%						\$205,110 \$51,278
Subtotal	20.070						\$256,388
Estimating Contingency	10.0%						\$25,639
Total Probable Construction Cost							\$282,027
	Average Cost per Linear Foot Including Steam and Condensate Piping & Fittings						\$78.36
<u> </u>		3.14 001140	aco i iping	~ · · · · · · · · · · · · · · · · · · ·	97	i	Ψ/0.50

1. COMPONENT Army	FY 1996 MILITARY CONSTRUCTION PROJECT DATA			2. DATE September 1995
3. INSTALLATION AND LOCATION  Hawthorne Army Ammunition Depot Nevada		4. PROJECT TITLE ECIP Modernize Ordna	ance Area	Steam Distribution
5. PROGRAM ELEMENT	6. CATEGORY CODE 8000	7. <b>PROJECT NUMBER</b> 42166	8. PR	OJECT COST (\$000) 1,242.8

### 9. COST ESTIMATES

7. COST ESTIMATES	T			
Item	U/M	Quantity	Unit Cost	(\$000)
Primary Facilities, above ground and direct buried piping replacements:	O/1/2	Quantity	Cost	976.3
Manhole A5 to Manhole A11	LF	3,538	136.69	(483.6)
Manhole D2 to Manhole D4	LF	1,336	130.15	(173.9)
Manhole A18 to Building 108-20	LF	642	128.63	(82.6)
Manhole A5 to Building 103-40	LF	710	54.49	(38.8)
Building 103-6 to Manhole C3	LF	1,394	109.14	(152.1)
Manhole B8 to Manhole B9-1	LF	560	81.05	(45.4)
Supporting Facilities	LS	_		0
Estimated Contract Cost				976.3
Contingency 10%				97.6
Subtotal				1,074.0
Supervision, Inspection and Overhead 5.6%				60.1
Design 6%				64.4
Unescalated CWE				1,198.5
Escalation to Midpoint of Construction: 1 December 1996				44.3
Total Request				1,242.8

### 10. DESCRIPTION OF PROPOSED CONSTRUCTION

Replace about 8,180 linear feet of steam and condensate return piping in the Ordnance Area. Replacement piping will be above ground as much as possible to reduce repair costs and to improve reliability. Street and railroad crossings will be made via separate preengineered conduit piping systems. The above ground piping systems will be built up systems with service pipe and field installed insulation and aluminum jacketing. Steam service piping will be schedule 40 steel and condensate return piping will be schedule 80 steel for both above and underground systems. Insulation and conduit for the underground replacement piping will be as specified in Corps of Engineers Guide Specification (CEGS) 02695, Preapproved Underground Heat Distribution System. Insulation and aluminum jacketing for above ground replacement piping will be sized and field installed in accordance with the latest requirements of CEGS 02697, Aboveground Heat Distribution System.

Validation of savings: Energy savings will be measured by comparing the fuel consumption for the heating plant in building 103-6 before and after the new steam and condensate piping is installed. The heating requirements, including heating degree days and building utilization, will be taken into account when comparing the consumption values.

<u>PROJECT</u>: Replace approximately 8,180 LF of selected steam and condensate return piping in the Ordnance Area currently direct buried or installed in shallow concrete trenches.

<u>REQUIREMENT</u>: This project will contribute toward achieving Department of Defense facility energy goals of a 20-percent reduction in energy use per gross square feet by FY2000 versus FY1985 baseline levels.

This project will save \$220,708 annually, comprised of \$101,447 from fuel oil savings and \$119,261 per year from maintenance cost savings. These savings result in a 5.43-year simple payback period and a savings-to-investment ratio of 2.39. Annual fuel savings are estimated at 16,549 Million BTU per year.

<u>CURRENT SITUATION</u>: Selected existing buried steam supply and condensate return piping is in a deteriorated state. Much of this piping is over twenty years old and is corroded. Insulation is deteriorated and leakage of steam and condensate is prevalent. Repairs to the existing systems are required frequently and are becoming more costly due to the deteriorated state of the systems and the need to excavate to locate the leaks.

IMPACT IF NOT PROVIDED: If this project is not accomplished, annual expenses of about \$220,708 for fuel and maintenance will be incurred that could have been avoided. Additionally, the potential of losing heating service to buildings served will be greatly increased. If this project is not approved, it will have a negative impact on the HWAAD energy program and will impede progress towards compliance with DEPPM 91-2.

<u>ADDITIONAL</u>: This project has been coordinated with the installation security plan, and no security improvements are required. This project incorporates recommendations of the Energy Engineering Analysis Program, Limited Energy Study of Steam Distribution Systems, performed under Contract No. DACA05-92-C-0155.

This installation is not under consideration for realignment or closure.

JOHN G. ZODROW Lt. Colonel Commanding

Estimate Date: 1 September 1995 Index: 1975

Estimated Construction Start: 1 September 1996 Index: 2032
Estimated Midpoint of Construction: 1 December 1996 Index: 2048
Estimated Construction Completion: 1 March 1997 Index: 2060

**DD FORM 1391C** 

LOCATION: Hawthorne Army Ammunition Depot, Nevada Date: September 1995

PROJECT TITLE: ECIP Modernize Ordnance Area Steam Distribution

### **Detailed Justification**

- 1. GENERAL: The project is a significant part of Hawthorne Army Ammunition Depot's effort to achieve a 20-percent reduction in energy consumption by FY2000 versus FY1985 baseline levels. The project will also assure that heating services are provided to Ordnance Area facilities on a continuing basis, supporting mission requirements.
- 2. ACCOMMODATIONS NOW IN USE: Not applicable.
- 3. ANALYSIS OF DEFICIENCY: The present condition of steam distribution and condensate collection piping contributes to unnecessary annual energy consumption and maintenance expenses totaling about \$220,708 per year. These costs will be avoided with implementation of the proposed project.
- 4. CONSIDERATION OF ALTERNATIVES: Alternative piping materials and placement methods were considered. The least costly alternatives are recommended for implementation. The recommended retrofits are those selected in the Limited Energy Study of Steam Distribution Systems, September 1995, prepared under Contract No. DACA 05-C-92-0155.
- 5. CRITERIA FOR PROPOSED CONSTRUCTION: Design and construction will be in accordance with applicable criteria established in:
  - a. DOD 4270.1-M
  - b. TM 810-5
  - c. Architectural and Engineering Instruction, dated 9 December 1991
  - d. A-E Guide Instruction for Army Projects, Volume 1, dated January 1990
  - e. A-E Guide, CESPK Cost Estimating Guide, Volume 2, dated December 1989
  - f. A-E Guide Volume III, Specifications, dated December 1990
  - g. Energy Conservation Investment Program (ECIP) Guidance, dated 10 January 1994.
  - h. TM 5-785, Engineering Weather Data
  - i. MCASES instructions
  - j. TM 5-652, Steam / Hot Water and Chilled Water Distribution Systems Operations and Maintenance Manual
  - k. CEGS-02695, Preapproved Underground Heat Distribution System
  - 1. CEGS-02696, Heat Distribution Systems in Concrete Trenches
  - m. CEGS-02697, Aboveground Heat Distribution System
- 6. PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT: Not applicable.
- 7. DISPOSAL OF PRESENT ASSETS: Not applicable.
- 8. SURVIVAL MEASURES: Not applicable.

LOCATION: Hawthorne Army Ammunition Depot, Nevada Date: September 1995 PROJECT TITLE: ECIP Modernize Ordnance Area Steam Distribution

- 9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES: Atmospheric emissions will be reduced as less fuel will be used due to this project. Temporary conditions will exist during the construction period consisting primarily of fugitive dust emissions.
- 10. EVALUATION OF FLOOD HAZARDS AND ENCROACHMENT ON WETLANDS: Not applicable
- 11. ECONOMIC JUSTIFICATION: In accordance with ECIP Guidance dated 10 December 1994, an economic analysis has been prepared. Life-cycle cost analysis results are summarized as follows:

	T 10	
•	Estimated Construction Cost (including	SIOH and design costs) \$1,198,535
•	Annual Energy Savings	16,549 MBTU (2,907,250 MJ)
•	First Year Energy Cost Savings	\$101,447
•	First Year Non-energy Cost Savings	\$119,261
•	Total First Year Cost Savings	\$220,708
•	Discounted Energy Savings	\$1,443,592
•	Discounted Non-energy savings	\$1,423,970
•	Total Net Discounted Savings	\$2,867,562
•	Savings-to-Investment Ratio	2.39
•	Simple Payback Period	5.43 years

Refer to "Detailed Calculations" for backup data.

- 12. UTILITY AND TELECOMMUNICATIONS SUPPORT: Not applicable.
- 13. PROTECTION OF HISTORIC PLACES AND ARCHEOLOGICAL SITES: Review procedures have been implemented for this project in accordance with 36 CFR 800. The review has established that there will be no effect.
- 14. PROJECT DEVELOPMENT BROCHURE: A Project Development Brochure (PDB-1) dated September 1995 has been prepared.
- 15. ENERGY REQUIREMENTS: Not applicable.
- 16. PROVISION FOR THE HANDICAPPED: Not applicable.
- 17. REAL PROPERTY MAINTENANCE ACTIVITY ANALYSIS: Not applicable.
- 18. COMMERCIAL ACTIVITIES: This project involves replacement or modification of existing systems for energy conservation. Under these conditions, the provisions of AR 5-XX do not apply, and a "new start or expansion" is not required.

# **Life Cycle Cost Analysis Summary - Ordnance Area Energy Conservation Investment Program (ECIP)**

Location: Hawthorne Army Ammunition Depot Region No. 4 Project No. 42166 Project Title: ECIP Modernize Ordnance Area Steam Distribution Fiscal Year FY97 Discrete Portion: Total Project Preparer: KELLER & GANNON Analysis Date September 1995 Economic Life: 15 Years 1. Investment Costs A. Construction Costs \$1,073,956 B. SIOH 5.6% \$60,142 C. Design Cost 6.0% \$64,437 D. Total Cost (1A + 1B + 1C)\$1,198,535 E. Salvage Value of Existing Equipment \$0 F. Public Utility Company Rebate \$0 G. Total Investment (1D-1E-1F) \$1,198,535 2. Energy Savings (+)/Cost(-): Date of NISTIR 85-3273 Used for Discount Factors: October 1994 Energy Cost Saving Annual \$ Discount Discounted Source \$/MBTU MBTU/Yr(2) Savings(3) Factor(4) Savings(5) A. Elec. \$12.82 0 \$0 12.02 \$0 B. Dist \$6.13 16,549 \$101,447 14.23 \$1,443,592 C. LPG D. Other E. Demand Savings 0.0 kW \$0 11.30 \$0 F. Total 16,549 \$101,447 \$1,443,592 3. Non Energy Savings (+) or Cost (-): A. Annual Recurring (+/-) \$119,261 (1) Discount Factor (Table A) 11.94 (2) Discounted Savings/Cost (3A x 3A1) \$1,423,970 B. Non Recurring Savings (+) or Cost (-) Item Savings(+) Year of Discount Discounted Sav-Cost(-)(1) Occur. (2) Factor(3) ings(+)Cost(-)(4)a. b. c. d. Total C Total Non Energy Discounted Savings (3A2+3Bd4) \$1,423,970 4. First Year DollarSavings (2F3+3A+(3Bd1/Economic Life)): \$220,708 5. Simple Payback (1G/4): 5.43 Years 6. Total Net Discounted Savings (2F5 + 3C): \$2,867,562 7. Savings to Investment Ratio (SIR) (6/1G): 2.39

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# **DD Form 1391 Detailed Calculations**

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# **Comparison of Replacement Piping Alternatives**

A typical pipe section is evaluated. The Ordnance Area is an explosives processing area with structures widely separated. All existing piping is underground. Alternatives evaluated include consideration of both above and underground piping replacements. In the above ground option, all piping is above ground except at street and rail crossings. Nominal heights for above ground piping is between 2 and 4 feet to the bottoms of the pipe supports.

Alternatives consider both prefabricated piping systems and built-up piping systems. The costs summarized below are intended exclusively for comparing one type of system against another. Some cost elements that affect all alternatives equally are not considered.

The predominant pipe run in the Ordnance Area, and the pipe sizes used to evaluate alternatives, consists of an 8-inch diameter steam pipe and a 4-inch diameter condensate return pipe. Cost estimates for comparison pipe segments follow.

F	١	b	O	١	e'	G	r	O	u	n	d	1	١	t	eı	T	ıa	ti	٧	es	,

# Comparison First Cost \$/LF

Alternative A1:

22-inch Conduit containing 8-inch Schedule 40 Steam Pipe with 2-inch Insulation and 4-inch Schedule 80 Condensate Pipe with

\$361.58

1-Inch Insulation

**Alternative A2:** 

16-inch Conduit containing 8-inch Schedule 40 Steam Pipe with

\$343.84

2-inch Insulation &

10-3/4-inch Conduit with 4-inch FRP Condensate Pipe with

1-Inch Insulation

**Alternative A3:** 

16-inch Conduit containing 8-inch Schedule 40 Steam Pipe with

\$373.59

2-inch Insulation &

10-3/4-inch Conduit with 4-inch Schedule 80 Condensate Pipe

with 1-Inch Insulation

Alternative A4:

8-inch Schedule 40 Steam Pipe with 2-inch Insulation and

\$170.57

Aluminum Jacket - Built Up &

4-inch Schedule 80 Condensate Pipe with 1-Inch Insulation &

Aluminum Jacket - Built Up

### **Underground Alternatives**

## Comparison First Cost \$/LF

Alternative U1:

22-inch Conduit containing 8-inch Schedule 40 Steam Pipe with

\$343.15

2-inch Insulation and 4-inch Schedule 80 Condensate Pipe with

1-Inch Insulation

Alternative U2:

16-inch Conduit containing 8-inch Schedule 40 Steam Pipe with

\$350.47

2-inch Insulation &

10-3/4-inch Conduit with 4-inch FRP Condensate Pipe with

1-Inch Insulation

**Alternative U3:** 

16-inch Conduit containing 8-inch Schedule 40 Steam Pipe with

\$380.22

2-inch Insulation &

10-3/4-inch Conduit with 4-inch Schedule 80 Condensate Pipe

with 1-Inch Insulation

# **Comparison of Replacement Piping Alternatives**

# **Comparison of Repair Costs**

Repairs are more difficult, and costly, for two-pipe conduit systems and for buried pipe systems. Repairs for conduit systems require that the conduit be opened up and the leaking section replaced. For two-pipe conduit systems, both pipes are replaced when one is found leaking. Repair costs are similar to original installation costs. Repairs to single pipe conduit systems are less costly, but still involve cutting through and repairing both the service pipe and the conduit. Repairs to piping in concrete trenches do not incur the expense of re-excavating, nor is there the same level of danger of accidentally digging into the pipe. Repairs to above ground piping systems are the least expensive.

Maintenance costs are higher for systems which contain FRP piping because thermal protective devices installed on all condensate entries must be maintained and defective parts replaced. The installed cost per LF of these protective devices is expensed twice during the life of the piping to represent additional maintenance and repairs required for these systems. Results are indicated below.

For purposes of comparison, frequencies of repair during a pipe segment's lifetime are considered. Results are shown below.

# **Recommended Replacement Piping Configurations**

Descriptions of Alternatives	\$/LF	Repairs/	Added	Overall	
Descriptions of Alternatives	<b>ず/</b> 上	Life	Maint	Cost/LF	
Above Ground Alternatives				***************************************	
Alternative A1	\$361.58	1	\$0.00	\$723.16	
Alternative A2	\$343.84	0.75	\$28.10	\$629.82	
Alternative A3	\$373.59	0.5	\$0.00	\$560.38	
Alternative A4	\$170.57	0.25	\$0.00	\$213.22	Predominant
Underground Alternatives				•	
Alternative U1	\$343.15	1	\$0.00	\$686.30	
Alternative U2	\$350.47	0.75	\$28.10	\$641.43	
Alternative U3	\$380.22	0.5	\$0.00	\$570.34 <b>←</b> F	or Road & Rail Crossings

Table 1
Summary of Piping Replacement Costs
Ordnance Area Steam Distribution

(Road and Rail Crossings Underground)

		Recor	nmended
Pipe Run Description	<u>\$/LF</u>	Total LF	Cost \$
MH A5 to MH A11	\$150.35	3,538	\$531,951
MH D2 to MH D4	\$143.16	1,336	\$191,263
MH A18 to Bldg 108-20	\$141.49	642	\$90,837
MH A5 - Bldg 103-40	\$60.04	710	\$42,631
Bldg 103-6 to MH C3	\$120.05	1,394	\$167,348
MH B8 to MH B9-1	\$89.15	560	\$49,925
<b>Total Ordnance Area Piping</b>	\$131.29	8,180	\$1,073,956
SIOH 5.6%			\$60,142
Design 6.0%			\$64,437
Total Request	\$146.52	8,180	\$1,198,535

Refer to Figure 1 for locations of piping replacements

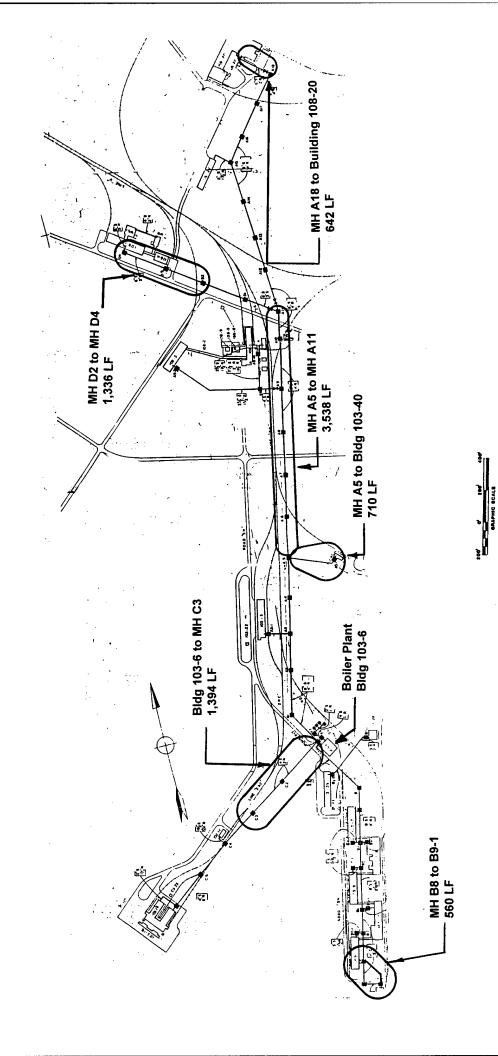


Figure 1
Recommended Steam Distribution System Piping Replacements

# Annual Energy and Maintenance Cost Savings Calculations Hawthorne Army Ammunition Depot - Ordnance Area

Replacing existing deteriorated piping will save both energy and maintenance costs. Energry savings result from reducing leakage from steam and condensate pipes and from reduced conduction/convection losses due to the installation of replacement piping with proper insulation.

# **Energy Savings Calculations**

# **Boiler Plant Name Plate Data**

## Boiler Building 103-6 - Ordnance Area

Boilers:

3 Each, Water Tube Boilers, Style 1 MV Operating Pressure:

112 psig

Boiler Fuel:

No. 2 Diesel Fuel Oil (High Sulfur)

345 °F

 $h_t =$ 

316.94 BTU/Lb

 $h_{fg} =$ 

874.4 BTU/Lb

Coen Burner Natural Gas or Oil at 19,700 CFH of 1,000 BTU/CF Natural Gas

Boiler No. 24 FYR Compak Packaged Burner, Coen File D-6210-1 Boiler No. 25 FYR Compak Packaged Burner, Coen File D-6437

Boiler No. 26 FYR Compak Packaged Burner, Coen File D-6210-2

Burner controls disconnected from flue sensor and automatic controls, burners are trimmed manually

Boiler Feed Pumps:

2 Each, at 20 HP, and 1 Each at 15 HP

**Boiler Efficiency Tests:** 

Boiler No.	Oxygen %	<u>Temp</u> °F	Eff %	<b>Condition</b>
24	9.4%	380	84.8%	<b>Boiler Cold</b>
24	9.3%	480	80.2%	High Fire
25	8.5%	270	85.4%	Boiler Cold
25	7.2%	420	82.3%	High Fire
25	8.5%	270	85.4%	Boiler Cold
25	7.2%	400	82.5%	High Fire
26		Not Ope	rating	•

For plant efficiency calculations, the high firing efficiency is used since it more closely follows actual operations.

# **Boiler Plant Efficiency Calculations**

	Steam Plant	
	Bldg 103-6	
Firing (Combustion) Efficiency Test	81.6%	Weighted average of efficiencies
Auxiliary Equipment Uses	-2.0%	allowance for steam ejectors
Radiation Losses @ Figure D-1	-2.0%	•
Blowdown Losses (Continuous BD)	-1.5%	
Leaks (Minimal at boiler houses)	-1.0%	Not including distribution leakage
Conduction/Convection	-2.5%	3
(Plant only, not including distribution piping; sy	stems rated in "poor'	condition due only to age, well maintained.)
Shut-Down/Cycling Losses	-4.0%	Boilers oversized for current load.
General Equipment Condition	-3.0%	
(Plant only systems rated in "poor" condition	due only to age, well	maintained.)

**Overall Plant Efficiencies** 

65.6%

# Steam Leakage and Condensate Energy Loss Calculations

Makeup water records are summarized for each of the boiler system. Steam production data is not available.

Steam Plant Bldg 103-6

Most recent calendar year May '94 through April '95: Calendar Year 1994:

1,503,591 Gallons 1,138,040 Gallons

The most recent calendar year data is used in steam and condensate energy loss calculations.

These losses include both steam and condensate leaks. Steam leakage represents a much greater energy loss than does the leakage of condensate. This is illustrated below:

Energy needed to raise makeup water from 50°F (raw water temperature) to 200°F, the condensate return temperature: 150.0 BTU per pound water

Energy needed to raise the 200°F condensate to 341°F, the saturation temperature of 105 psig steam: 144.4 BTU per pound water

Energy needed to vaporize 341°F water at 105 psig (heat of evaporation):

877.9 BTU per pound water

Thus, a steam leak includes loss of the useful work the steam can perform (heat of evaporation) and the energy required to heat makeup water to the vaporization temperature, all three of the above elements, or 1,172.2 BTU per pound water

A condensate leak includes only the energy needed to raise raw makeup water to the condensate return temperature, or 150.0 BTU per pound water

The following calculation shows the percent of total steam plant fuel consumption represented by steam and condensate losses where total losses are attributed exclusively to either steam or condensate.

	Steam Pl	ant 103-6	
Energy Losses	KK BTU/Yr %	Total Fue	1
If Leakage is 100% Steam:	14,730	40.8%	
If Leakage is 100% Condensate:	3,752	10.4%	
Assumes water temp of 50 °F, h <sub>i</sub> = 18.1 BTU/L	B; Fuel Oil at	138,700	BTU/Gallon

Based on field observations, it appears that most of the makeup water loss is composed of condensate that is not returned to the central plants. There are only a few steam leaks. Conservatively, then, assume 10% of the losses in the Ordnance Area are from condensate. Blowdown is included in makeup water requirements and constitutes about 2% of the total steam flow. This use is subtracted from the loss calculations below. The annual energy savings from repairs to the distribution systems are:

	Ordnance Area
	Steam Plant 103-6
Energy Losses	KK BTU/Yr
Loss from Steam Leakage	1,473
Loss from Condensate Leakage	3,377
Thermal Losses	4,850
Boiler Plant Efficiency	65.6%
Makeup Water Fuel Uses	7,396
Blowdown Loss (2% of fuel input)	721
Leakage Fuel Losses (No 2 Fuel Oil)	6,675

Significant additional losses occur from poorly insulated steam and condensate lines. Leakage of steam and condensate has wetted the insulation (if present) to such an extent that little insulating value remains.

# **Energy Savings from Piping Insulation Losses**

Existing piping is deteriorated and leaks have destroyed the value of insulation installed on existing piping. Insulation thermal losses are determined for existing and proposed future piping systems. Detailed calculations follow. Results are summarized here:

Energy Savings	Ordnance Area Steam Plant 103-6 KK BTU/Yr
Load Saved (Heating Season Only)	6,475
Boiler Plant Efficiency	65.6%
Insulation Savings (No 2 Fuel Oil)	9,875
Total Fuel Oil Savings	16,549

# **Operation and Maintenance Cost Savings**

The proposed new piping systems will reduce operation and maintenance costs significantly. Cost savings for each area are determined below.

Proposed piping replacements will be predominantly above ground. Installation above ground should reduce the magnitude chronic breaks experienced along certain stretches of piping. Repairs will be performed on piping without having to either dig up conduit sections or to enter manholes.

With the newly enforced confined space entry procedures, limiting access requirements into manholes should significantly reduce costs as an extra worker will not be required to be present to assist in evacuations.

Overall, the piping replacements in the Ordnance Area are expected to save about 3/4 of present maintenance costs according to maintenance supervisors. During the last year for which records are available, about 4,300 hours per year were spent on preventive maintenance, service calls and on major repairs. Based on a steamfitter rate of \$42.33 per Hour and helper rate of \$31.63 (Means Steamfitter & Helper, location adjusted) and 3/4 of the total maintenance hours, savings are expected to total:

4,300 hours year  $\times$  3/4  $\times$  \$36.98 per hour = \$119,261 per year, including overhead.

# Thermal Loss Calculations for New and Deteriorated Existing Steam Distribution & Condensate Piping Piping Systems

Nominal Pipe Size	-	1.25	1.5	7	2.5	က	4	ro	ဖ	∞
Pipe Diameter Schedule 40 for Steam Service	9 40 for St	eam Se	rvice							
Pipe OD (Inches)	1.182	1.52	1.755	2.221	2.672	3.284	4.263	5.305	6.345	8.303
Pipe ID (Inches)	1.049	1.38	1.61	2.067	2.469	3.068	4.026	5.047	6.065	7.981
Insulation Thickness (Min	neral Wool	~								
Above Ground (Inches)	2.5	2.5	2.5	3.5	3.5	4.0	4.0	4.0	4.5	4.5
Pipe Trench (Inches)	2.0	2.0	2.5	2.5	2.5	3.0	3.0	3.0	3.5	3.5
UG Conduit (Inches)	2.0	2.0	2.0	2.5	2.5	3.0	3.0	3.0	3.5	3.5
Conduit Casing (Inch)	6.625	6.625	6.625	8.625	8.625	10.750	12.750	12.750	16.000	18.0
Air Space (Inches)	0.813	0.688	0.563	0.813	0.563	0.875	1.375	0.875	1.500	1.500
Pipe Diameter Schedule 80 for Condensate Service	80 for Co	ondensa	te Servi	ce						
Pipe OD (Inches)	1.136	1.469	1.7	2.157		3.2	4.163	5.188	6.193	8.125
Pipe ID (Inches)	0.957	1.278	1.5	1.939	2.323	2.9	3.826	4.813		7.625
Insulation Thickness (Mineral Wool	eral Wool	_								
Above Ground (Inches)	2.0	2.0	2.0	2.0	2.0	2.5	2.5	•	,	•
Pipe Trench (Inches)	1.5	1.5	1.5	1.5	1.5	2.0	2.0	1		•
UG Conduit (Inches)	1.5	1.5	1.5	1.5	1.5	2.0	2.0	•	ı	•
Conduit Casing (Inch)	6.625	6.625	6.625	8.625	8.625	10.750	10.750	1		•
Air Space (Inches)	1.313	1.188	1.063	1.813	1.563	1.875	1.375	•	•	

F:\PROJ\1640320\ENGR\BLR-1391.XLS Pipe Program

Thermal Loss Calculations for New and Deteriorated Existing Steam Distribution & Condensate Piping

		,	1				,							4	Brass	290.0
															P. P.	270.4 28
		•	•	•		•	•			•	•					
		•	٠	•		•	•			,	٠	•	Pipe	. ო	FR	251.0
		,		•		,				•	1	1	l Bare	7	Brass	244.9
2.5 LPS		,	37.9						2.5 LPS	•	100.4	ı	Buriec			221.6 244.9
		ı	•	•			,			,		,		1.5	Brass	232.2
2 LPS		,	34	, ,		1			2 LPS	,	86.6			1.5	FRP	201.4
œ		78.0	91.2	81.6		,	,	•		411.1	374.0	263.4		ı	,	Ī
ဖ		65.0	75.3	67.9			ı			322.3	293.5	217.7		,	ı	
2		62.3	73.5	66.1			ı			274.8	250.5	189.0		ı	•	
4		54.3	63.5	57.7		39.7	44.5	38.7		226.9	207.0	163.8	5	120.8	109.2	197.0
က		46.6	53.9	49.2		33.4	37.2	32.7	ing		166.0	134.7	ed Pipin	9.96	87.5	175.8
2.5		44.6	52.7	48.0		33.4	38.3	33.7	iorated Piping	152.9	140.1 166.0	115.8	<b>Deteriorated Piping</b>	81.4	73.9	154.0
7	ng	40.4	47.3	43.3	v Piping	29.8	33.9	30.1	Deterior	131.7					63.8	139.8
1.5	lew Pipi	42.3	41.5	37.5 42.5 43.3	rice, Nev	25.9	29.3	26.0	xisting,	109.5	100.8	86.9 102.5	ice, Exis	58.3	53.2	106.5 116.1
1 1.25 1.5	ervice, N	39.2	37.6 42.9 41.5	37.5	ate Serv	23.9	26.9	24.0	rvice, E	98.2	75.6 90.5 100.8 120.9	79.2	ate Serv	52.3	47.8	106.5
_	team Se	34.6	37.6	34.8	ondens	18.9	23.3	20.9	team Se	81.8	75.6	67.2	ondens	43.5	39.9	90.3
Nominal Pipe Size	Nominal Size Sch 40 for Steam Service, New Piping	Above Ground (BTUH/LF) 34.6 39.2 42.3 40.4	Pipe Trench (BTUH/LF)	UG Conduit (BTUH/LF)	Nominal Size Sch 80 for Condensate Service, New Piping	Above Ground (BTUH/LF) 18.9 23.9 25.9 29.8	Pipe Trench (BTUH/LF)	UG Conduit (BTUH/LF)	Nominal Size Sch 40 for Steam Service, Existing, Deteri	Above Ground (BTUH/LF) 81.8 98.2 109.5 131.7	Pipe Trench (BTUH/LF)	UG Conduit (BTUH/LF)	Nominal Size Sch 80 for Condensate Service, Existing,	Above Ground (BTUH/LF) 43.5 52.3 58.3 70.1	Pipe Trench (BTUH/LF)	UG Conduit (BTUH/LF)

Ordnance Area Thermal Loss Savings from Selected Piping Replacements (Refer to results of Pipe Heat Loss Calculations)

		Proposed			Current	Proposed	Heat Load	KK BTU/Yr
Ordnance Area	Service	<b>Placement</b>	Dia	비	BTUH/LF	BTUH/LE	Saved BTUH	Saved
MH A5 to Bldg 103-40	COND	AG	7	355	116.1	25.9	32,021	140.3
Bldg 103-6 to MH C3	COND	AG	7	627	139.8	29.8	68,970	302.1
MH D2 to MH D4	COND	AG	က	180	175.8	33.4	25,632	112.3
MH A5 to MH A11	COND	AG	4	1,769	197.0	39.7	278,264	1218.8
MH A18 to Bldg 108-20	COND	AG	7	30	116.1	25.9	2,706	11.9
MH B8 to MH B9-1	COND	AG	7	250	139.8	29.8	27,500	120.5
MH A5 to Bldg 103-40	STM	AG	ო	355	134.7	46.6	31,276	137.0
Bldg 103-6 to MH C3	STM	AG	4	627	163.8	54.3	68,657	300.7
MH D2 to MH D4	STM	AG	9	180	322.3	65.0	46,314	202.9
MH A5 to MH A11	STM	AG	∞	1,769	411.1	78.0	589,254	2580.9
MH A18 to Bldg 108-20	STM	AG	က	30	154.0	48.0	3,180	13.9
MH B8 to MH B9-1	STM	AG	4	250	163.8	54.3	27,375	119.9
Bldg 103-6 to MH C3	COND	UG Conduit	7	20	139.8	30.1	629'2	33.6
MH A18 to Bldg 108-20	COND	<b>UG</b> Conduit	က	280	175.8	32.7	40,068	175.5
MH D2 to MH D4	COND	<b>UG Conduit</b>	က	488	175.8	32.7	69,833	305.9
MH A5 to MH A11	COND	<b>UG Conduit</b>	4	6	197.0	38.7	14,247	62.4
MH B8 to MH B9-1	COND	UG Conduit	7	30	139.8	30.1	3,291	14.4
Bldg 103-6 to MH C3	STM	UG Conduit	4	20	163.8	57.7	7,427	32.5
MH A18 to Bldg 108-20	STM	<b>UG Conduit</b>	9	280	217.7	67.9	41,944	183.7
MH D2 to MH D4	STM	<b>UG</b> Conduit	ဖ	488	217.7	67.9	73,102	320.2
MH A5 to MH A11	STM	<b>UG Conduit</b>	œ	90	263.4	81.6	16,362	71.7
MH B8 to MH B9-1	STM	<b>UG Conduit</b>	4	30	163.8	57.7	3,183	13.9
Note: Current placement is buried conduit systems in very poor repair.	it is buriec	l conduit syste	ems ir	very i	poor repair.			
Total Thermal Loss Load Saved from Replacing Piping (KK BTU/Year)	ad Save	l from Repla	cing l	Piping	(KK BTU/)	(ear)		6,475
Boiler Plant Efficiency								65.6%
Fuel Oil Savings of Piping Thermal Losses (kk BTU/Year)	oing Ther	mai Losses	(독 교	TU/Ye	ar)			9,875

				Date Prepared	<u> </u>	Sheet	of
CONSTRUCTION CO	OST E	STIM	ATE		nber-95	1	7
Project				Project No.	Basis for Estin	nate	
ECIP Modernize Ordnance A	rea Stea	am Dis	stribution		2000 101 200		
Location				1111 12100	1		
Hawthorne Army Amn	nunition	Dono	t Novad	^		,	
Engineer-Architect	TUTILIOT	Depu	i, Nevau	<u>a</u>	Code A	(no design co	mpeted)
Keller & Gannon							
Drawing No.			Estimator		Checked By		
Replace Pipes from MH A5	to MH	A11		LN	i i	BIH	
	Qua		1	abor	Mat	erial	
Line Item	No.	Únit	Per	<u> </u>		<u> </u>	Total
	Units	Meas.	Unit	Total	Per Unit		Cost
(Aboveground piping: built-up stea							
8-inch/4-inch	1,769	LF	\$68.84	\$121,776	\$60.52	\$107,055	\$228,831
SUPPORTS	55	EA	\$337.01	\$18,674	\$290.00	\$16,069	\$34,744
STEAM VALVES							
8-inch	5	EA	\$344.50	\$1,722	\$2,282.20	\$11,411	\$13,134
6-inch	1	EA	\$292.88	\$293	\$1,448.76	\$1,449	\$1,742
4-inch	1	EA	\$202.53	\$203	\$929.92	\$930	\$1,132
3-inch	1 1	EA	\$146.75	\$147	\$727.35	\$727	\$874
COND VALVES							
4-inch	5	EA	\$202.53	\$1,013	\$929.92	\$4,650	\$5,662
3-inch	1	EA	\$146.75	\$147	\$727.35	\$727	\$874
2-inch	1	EA	\$99.75	\$100	\$182.27	\$182	\$282
1 1/2-inch	2	EA	\$76.98	\$154	\$139.58	\$279	\$433
STEAM TEES							
8-inch	10	EA	\$371.13	\$3,711	\$162.91	\$1,629	\$5,340
COND TEES							
4-inch	13	EA	\$251.53	\$3,270	\$84.92	\$1,104	\$4,374
45 ELBOWS (COMMON)							
8-inch/4-inch	2	EA	\$441.09	\$882	\$164.40	\$329	\$1,211
6-inch/3-inch	1	EA	\$347.39	\$347	\$119.21	\$119	\$467
90 ELBOW (COMMON)							
8-inch/4-inch	24	EA	\$441.09	\$10,586	\$199.51	\$4,788	\$15,374
6-inch/3-inch	1	EA	\$347.39	\$347	\$132.71	\$133	\$480
4-inch/2-inch	2	EA	\$260.24	\$520	\$38.80	\$78	\$598
3-inch/2-inch	2	EA	\$207.29	\$415	\$61.14	\$122	\$537
ELBOWS (SINGLE-COND)							
1 1/2-inch	42	EA	\$86.54	\$3,635	\$23.63	\$992	\$4,627
ANCHORS							
8-inch/4-inch	4	EA	\$60.50	\$242	\$61.82	\$247	\$489
Miscellaneous Fittings							
2-inch DRIP NIPPLE	7	EA	\$21.50	\$151	\$33.00	\$231	\$382
1 1/2-inch'Steam Trap Assembly	7	EΑ	\$168.12	\$1,177	\$1,000.50	\$7,004	\$8,180
STM GAGE	1	EA	\$7.30	\$7	\$16.50	\$17	\$24
PRESSURE GAGE	1	EΑ	\$7.30	\$7	\$16.50	\$17	\$24

				Date Prepared		Sheet	of
CONSTRUCTION CC	STE	STIM	ATE		nber-95	2	7
Project				Project No.	Basis for Estin	nate	
ECIP Modernize Ordnance Are	ea Stea	m Dis	tribution	PN-42166			
Location				<b>1</b>	1		
Hawthorne Army Amm	unition	Deno	t Nevad	3	0-4-4	/	
Engineer-Architect	umilion	Depo	i, Nevau	<u> </u>	Code A	(no design co	mpetea)
Keller & Gannon							
Drawing No.			Estimator		Checked By		
Replace Pipes from MH A5	to MH	Λ11		LN	Checked by	ВІН	
Topiace i ipes ironi wiii A3	Qua			abor	Mate		_
Line Item	No.	Unit	Per	abor	iviati	eriai	Total
	Units	Meas.	Unit	Total	Per Unit	Total	Cost
(BELOW-GRADE PIPING: STM PIP	E IN CO	NDUIT	& COND	PIPE IN COI	NDUIT)		
8-inch/4-inch	90	LF	\$93.00	\$8,370	\$80.01	\$7,201	\$15,571
							<u> </u>
TRENCH/BACKFILL			-	**	7.7	****	
DIR-LAWN	40	LF	\$7	\$285	\$0.00	\$0	\$285
CONC-ROAD	50	LF	\$24	\$1,189	\$0.00	\$0	\$1,189
RR TRACKS	2	EA	\$750.00	\$1,500	\$0.00	\$0	\$1,500
STEAM PITS	5	EA	\$1,450	\$7,250	\$4,816	\$24,080	\$31,330
Subtotal				\$188,120		\$191,570	\$379,707
Nevada Sales Tax	3.75%	,				\$7,184	\$7,184
Subtotal						·	\$386,891
Contractor Overhead & Profit	25.0%						\$96,723
Subtotal							\$483,613
Estimating Contingency	10.0%						\$48,361
Total Probable Construction Cost							\$531,975
Average Cost per Linear Foot Includin	g Steam	and C	ondensate	Piping & Fit	tings		\$150.36

CONSTRUCTION COST ESTIMATE					Date Prepared	d	Sheet	of
Code   Modernize   Ordinance   Area   Steam   Distribution   PN-42166     Oceasion   Hawthorne   Army   Ammunition   Depot,   Nevada   Code   A (no design competed)	CONSTRUCTION CC	ST ES	STIM	ATE	1		3	7
	Project ECIP Modernize Ordnance Ar	ea Stea	am Di	stribution		Basis for Estir	nate	
Checked By   Che	Location				•			
Replace Pipes from MH D2 to MH D4		unition	Depo	t, Nevad	a	Code A	(no design c	ompeted)
Checked By   Che	_							
Replace Pipes from MH D2 to MH D4				I Cating atom		Ohaalaad Da		
Line   Item	_	to ML	ו ח		A NI	Спескеа ву	DILL	
Line   Item	Replace Fipes Iron Wiri Dz					Moi		1
Dubble   D	Line Item				aboi	1	leriai	Total
Simports   180								1
SUPPORTS   7					insulation 8	k aluminum j	ackets)	
STEAM VALVES   1					\$10,508	·	\$8,121	\$18,629
## Sample		7	EA	\$337.01	\$2,431	\$290.00	\$2,092	\$4,523
Sinch								
COND VALVES   Cond							<u> </u>	\$2,627
Sinch	6-inch	2	EA	\$292.88	\$586	\$1,448.76	\$2,898	\$3,483
1/2-inch		1	<u> </u>					
STEAM TEES   Signature   Steam Tees   Signature   Steam Tees   Signature   Steam Tees   Signature   Steam Tees   Signature   Steam Tees   Signature   Steam Tees   Signature   Steam Tees   Signature   Steam Tees   Signature   Steam Tees   Signature   Steam Tees   Signature   Signa								\$1,748
Sinch		8	EA	\$76.98	\$616	\$139.58	\$1,117	\$1,732
2   EA   \$141.04   \$282   \$47.23   \$94   \$37								
COND TEES								\$1,248
Hinch		<del>  2</del>	EA	\$141.04	\$282	\$47.23	\$94	\$377
1/2-inch				2122 22				
DELBOW (COMMON)   STITE   ST								\$989
Finch/3-inch   S		1	EA	\$112.94	\$113	\$37.58	\$38	\$151
LEBOWS (SINGLE-COND)		<del>                                     </del>		6047.00	00.770	0400 74	44.000	
1/2-inch		<del>  °</del>	EA	\$347.39	\$2,779	\$132.71	\$1,062	\$3,841
NCHORS		17	E^	\$0C E4	¢4 474	<b>#</b> 22.62	0.400	04.070
### SUIDES ####################################		1 '	LA	\$00.54	Φ1,47 I	\$∠3.03	\$402	\$1,873
### SUIDES		2	FΔ	\$50.62	¢110	¢52 27	¢107	\$226
Second   S			LA	ψ09.02	ψ11 <del>8</del>	Ψ03.3 <i>1</i>	\$107	\$226
Second   S		3	FΔ	\$27.65	\$83	\$219.00	\$657	\$740
-inch DRIP NIPPLE 3 EA \$21.50 \$65 \$33.00 \$99 \$164 1/2-inch'Steam Trap Assembly 3 EA \$168.12 \$504 \$1,000.50 \$3,002 \$3,506 \$1/2-inch'Steam Trap Assembly 3 EA \$168.12 \$504 \$1,000.50 \$3,002 \$3,506 \$1/2-inch'Steam Trap Assembly 5 EA \$168.12 \$504 \$1,000.50 \$3,002 \$3,506 \$1/2-inch'Steam Trap Assembly 6 EA \$1,000.50 \$3,002 \$3,506 \$1/2-inch'Steam Trap Assembly 7 \$38,928 \$70.71 \$34,506 \$73,434 \$1/2-inch'Steam Trap Assembly 7 \$38,928 \$70.71 \$34,506 \$73,434 \$1/2-inch'Steam Trap Assembly 8 LF \$79.77 \$38,928 \$70.71 \$34,506 \$73,434 \$1/2-inch'Steam Trap Assembly 8 LF \$79.77 \$38,928 \$70.71 \$34,506 \$73,434 \$1/2-inch'Steam Trap Assembly 8 LF \$7.12 \$3,261 \$0.00 \$0 \$3,266 \$1/2-inch'Steam Trap Assembly 8 LF \$7.12 \$3,261 \$0.00 \$0 \$3,266 \$1/2-inch'Steam Trap Assembly 8 \$1,450 \$1/2-inch'Steam Trap Assembly 8 \$1,		† –		Ψ27.00	ΨΟΟ	Ψ2 19.00	Ψ031	\$740
1/2-inch'Steam Trap Assembly   3   EA   \$168.12   \$504   \$1,000.50   \$3,002   \$3,506	2-inch DRIP NIPPLE	3	FA	\$21.50	\$65	\$33.00	\$90	\$164
### SELOW-GRADE PIPING: STM & COND PIPE IN CONDUIT  -inch/3-inch  ### RENCH/BACKFILL  DIR-LAWN  ONC-ROAD  ### ST7.12  ### ST7.12  ### ST7.12  ### ST7.13  ### ST7.		. 1						
Second		1		<b>V</b> ,00.72	<b>\$</b> 001	Ψ1,000.00	Ψ0,002	Ψ0,000
Second	BELOW-GRADE PIPING: STM & C	OND PIF	E IN C	ONDUIT				
RENCH/BACKFILL	6-inch/3-inch				\$38.928	\$70.71	\$34.506	\$73,434
CONC-ROAD         30         LF         \$23.78         \$713         \$0.00         \$0         \$713           VR TRACK         1         EA         \$750.00         \$750         \$0.00         \$0         \$750           TEAM PITS         2         EA         \$1,450         \$2,900         \$4,816.00         \$9,632         \$12,532           ubtotal         \$68,433         \$68,113         \$136,546           evada Sales Tax         \$2,554         \$2,554         \$2,554           ubtotal         \$139,100           contractor Overhead & Profit         25.0%         \$173,875           ubtotal         \$173,875           stimating Contingency         10.0%         17387.5           otal Probable Construction Cost         \$191,263	TRENCH/BACKFILL				,	4 . 411 1	+= .,555	<del>- + · 0 , · 0 +</del>
CONC-ROAD         30         LF         \$23.78         \$713         \$0.00         \$0         \$713           E/R TRACK         1         EA         \$750.00         \$750         \$0.00         \$0         \$750           TEAM PITS         2         EA         \$1,450         \$2,900         \$4,816.00         \$9,632         \$12,532           ubtotal         \$68,433         \$68,113         \$136,546           evada Sales Tax         3.75%         \$2,554         \$2,554           ubtotal         \$139,100         \$34,775           ubtotal         \$173,875           stimating Contingency         10.0%         \$17387.5           otal Probable Construction Cost         \$191,263	DIR-LAWN	458	LF	\$7.12	\$3,261	\$0.00	\$0	\$3.261
VR TRACK         1         EA         \$750.00         \$0.00         \$0         \$750.00           TEAM PITS         2         EA         \$1,450         \$2,900         \$4,816.00         \$9,632         \$12,532.00         \$12,532.00         \$12,532.00         \$136,546.00         \$136,546.00         \$136,546.00         \$139,100.00         \$139,100.00         \$139,100.00         \$139,100.00         \$173,875.00         \$173,875.00         \$173,875.00         \$173,875.00         \$173,875.00         \$173,875.00         \$173,875.00         \$191,263.00         \$191,263.00         \$191,263.00         \$191,263.00         \$191,263.00         \$191,263.00         \$100.00	CONC-ROAD	30						\$713
TEAM PITS         2         EA         \$1,450         \$2,900         \$4,816.00         \$9,632         \$12,532           ubtotal         \$68,433         \$68,113         \$136,546           evada Sales Tax         \$2,554         \$2,554         \$2,554           ubtotal         \$139,100         \$34,775           ubtotal         \$173,875         \$173,875           stimating Contingency         10.0%         17387.5           otal Probable Construction Cost         \$191,263	R/R TRACK	1						\$750
ubtotal       \$68,433       \$68,113       \$136,546         levada Sales Tax       3.75%       \$2,554       \$2,554         ubtotal       \$139,100       \$139,100         contractor Overhead & Profit       25.0%       \$34,775         ubtotal       \$173,875         stimating Contingency       10.0%       17387.5         otal Probable Construction Cost       \$191,263	STEAM PITS	2	EA					\$12,532
sevada Sales Tax   3.75%   \$2,554   \$2,554   \$2,554   \$2,554   \$2,554   \$139,100   \$139,100   \$139,100   \$139,100   \$139,100   \$173,875   \$17	Subtotal						<u> </u>	\$136,546
ubtotal         \$139,100           ontractor Overhead & Profit         25.0%         \$34,775           ubtotal         \$173,875           stimating Contingency         10.0%         17387.5           otal Probable Construction Cost         \$191,263	Nevada Sales Tax	3.75%						\$2,554
contractor Overhead & Profit         25.0%         \$34,775           ubtotal         \$173,875           stimating Contingency         10.0%         17387.5           otal Probable Construction Cost         \$191,263	Subtotal							\$139,100
ubtotal         \$173,875           stimating Contingency         10.0%         17387.5           otal Probable Construction Cost         \$191,263	Contractor Overhead & Profit	25.0%				***************************************		\$34,775
stimating Contingency     10.0%       otal Probable Construction Cost     \$191,263	Subtotal						7	\$173,875
otal Probable Construction Cost \$191,263	Estimating Contingency	10.0%						17387.52
	Total Probable Construction Cost							
5	Average Cost per Linear Foot Includir	ng Steam	and C	ondensate	Piping & Fit	ttings		\$143.16

CONSTRUCTION COST ESTIMATE					Date Prepared		Sheet	of
Project   ECIP   Modernize   Ordnance   Area   Steam   Distribution   PN-42166	CONSTRUCTION CO	ST E	NITS	ΔTE	1			
Coll   Modernize   Ordnance   Area   Steam Distribution   PN-42166	1	- C	<u> </u>	<u> </u>	·		1	
Location	l ·	oo Stor	m Die		1	Basis for Estin	nate	
Hawthorne Army Ammunition   Depot,   Nevada   Code A (no design competed)		ea Siea	אט וווג	Stribution	PN-42166	-		
Engineer-Architect   Keller & Gannon			_					
Color   Colo	Hawthorne Army Amm	unition	Depo	t, Nevad	a	Code A	(no design co	mpeted)
Drawing No.   Replace Pipes from MH A18 to Bids   108-20								
Replace Pipes from MH A18 to Bldg 108-20   DLN								
Country						Checked By		
Line   Item	Replace Pipes from MH A		_				BIH	
Units   Meas   Unit   Total   Per   Unit   Total   Cost	line House			I .	abor	Mat	erial	T.1.1
Aboveground piping: built-up steam & condensate lines with insulation & aluminum jackets   2 1/2-inch / 1 1/2-inch   30     LF     \$32.60     \$978     \$18.65     \$559     \$1,53	Line item			1	Total	  Per   Unit	Total	
2 1/2-inch / 1 1/2-inch   30	(Aboveground piping: built-up steam		4					0031
SUPPORTS	2 1/2-inch / 1 1/2-inch							\$1 538
STEAM VALVES								
6-inch 1 EA \$292.88 \$293 \$1,448.76 \$1,449 \$1,74  COND VALVES 3-inch 1 EA \$146.75 \$147 \$727.35 \$727 \$87.  90 ELBOW (COMMON) 6-inch/3-inch 4 EA \$347.39 \$1,390 \$132.71 \$531 \$1,92  GUIDES 6-inch/3-inch 1 EA \$27.65 \$28 \$219.00 \$219 \$24  Miscellaneous Fittings 2-inch DRIP NIPPLE 1 EA \$21.50 \$22 \$33.00 \$33 \$55  1 1/2-inch'Steam Trap Assembly 1 EA \$168.12 \$168 \$1,000.50 \$1,001 \$1,166  (BELOW-GRADE PIPING: STM PIPE IN CONDUIT & CONDENSATE PIPE IN CONDUIT 6-inch/3-inch 291 LF \$79.77 \$23,213 \$70.71 \$20,577 \$43,796  TRENCH/BACKFILL DIRT & LAWN 30 LF \$7.12 \$214 \$0.00 \$0 \$214  R/R TRACK 1 EA \$750.00 \$750 \$0.00 \$0 \$756  STEAM PITS 1 EA \$1,450 \$1,450 \$4,816 \$4,816 \$6,266  SUbtotal \$32,021 \$32,812 \$64,833  Subtotal \$32,021 \$32,812 \$64,833  Subtotal \$32,021 \$32,812 \$64,833  Subtotal \$82,575  Subtotal \$82,575  Estimating Contingency 10.0% \$82,255			<del></del>	4007.01	Ψο,ο,ο	Ψ200.00	Ψ2,300	\$0,270
COND VALVES   3-inch   1		1	FA	\$292.88	\$293	\$1 448 76	\$1 449	\$1.742
3-inch				<b>\$252.00</b>	<b>\$200</b>	Ψ1,440.70	Ψ1,443	Ψ1,7-42
90 ELBOW (COMMON) 6-inch/3-inch		1 1	FA	\$146.75	\$147	\$727.35	\$727	\$874
G-inch/3-inch		•		Ψ1 10.7 C	Ψ147	Ψ121.00	Ψ/2/	<del>\$014</del>
GUIDES 6-inch/3-inch 1 EA \$27.65 \$28 \$219.00 \$219 \$24  Miscellaneous Fittings 2-inch DRIP NIPPLE 1 EA \$21.50 \$22 \$33.00 \$33 \$55  1 1/2-inch'Steam Trap Assembly 1 EA \$168.12 \$168 \$1,000.50 \$1,001 \$1,166  (BELOW-GRADE PIPING: STM PIPE IN CONDUIT & CONDENSATE PIPE IN CONDUIT 6-inch/3-inch 291 LF \$79.77 \$23,213 \$70.71 \$20,577 \$43,796  TRENCH/BACKFILL DIRT & LAWN 30 LF \$7.12 \$214 \$0.00 \$0 \$214  R/R TRACK 1 EA \$750.00 \$750 \$0.00 \$0 \$756  STEAM PITS 1 EA \$1,450 \$1,450 \$4,816 \$4,816 \$6,266  Subtotal Nevada Sales Tax 3.75% Subtotal Contractor Overhead & Profit 25.0% Subtotal Estimating Contingency 10.0%		4	FA	\$347.39	\$1 390	\$132.71	\$531	\$1,020
Miscellaneous Fittings   2-inch DRIP NIPPLE   1	GUIDES	<u> </u>		4011.00	<b>\$1,000</b>	Ψ10Z.71	Ψ001	Ψ1,520
Miscellaneous Fittings   2-inch DRIP NIPPLE   1		1	FA	\$27.65	\$28	\$219.00	\$219	\$247
2-inch DRIP NIPPLE 1 EA \$21.50 \$22 \$33.00 \$33 \$55 1 1/2-inch'Steam Trap Assembly 1 EA \$168.12 \$168 \$1,000.50 \$1,001 \$1,165 1 1/2-inch'Steam Trap Assembly 1 EA \$168.12 \$168 \$1,000.50 \$1,001 \$1,165 1 1/2-inch'Steam Trap Assembly 1 EA \$168.12 \$168 \$1,000.50 \$1,001 \$1,165 1 1/2-inch'Steam Trap Assembly 1 EA \$168.12 \$168 \$1,000.50 \$1,001 \$1,165 1 1/2-inch'Steam Trap Assembly 1 EA \$1,000.50 \$1,001 \$1,001 \$1,165 1 1/2-inch'Steam Trap Assembly 1 EA \$1,000.50 \$1,000 \$1		<u> </u>		<b>\$27.00</b>	Ψ20	Ψ2 10.00	Ψ2.13	ΨΖΨ1
1 1/2-inch'Steam Trap Assembly		1	ΕA	\$21.50	\$22	\$33.00	\$33	\$55
Contractor Overhead & Profit   Stimple in Conduit & Conduit & Conduit & Conduit   Stimple in Conduit   Stimple i								
6-inch/3-inch 291 LF \$79.77 \$23,213 \$70.71 \$20,577 \$43,790  TRENCH/BACKFILL  DIRT & LAWN 30 LF \$7.12 \$214 \$0.00 \$0 \$214  R/R TRACK 1 EA \$750.00 \$750 \$0.00 \$0 \$750  STEAM PITS 1 EA \$1,450 \$1,450 \$4,816 \$4,816 \$6,266  Subtotal  Nevada Sales Tax 3.75% \$32,021 \$32,812 \$64,833  Subtotal  Contractor Overhead & Profit 25.0% \$16,516  Subtotal  Estimating Contingency 10.0% \$82,578				7.00	<b>V.00</b>	ψ1,000.00	Ψ1,001	Ψ1,100
6-inch/3-inch 291 LF \$79.77 \$23,213 \$70.71 \$20,577 \$43,790  TRENCH/BACKFILL  DIRT & LAWN 30 LF \$7.12 \$214 \$0.00 \$0 \$214  R/R TRACK 1 EA \$750.00 \$750 \$0.00 \$0 \$750  STEAM PITS 1 EA \$1,450 \$1,450 \$4,816 \$4,816 \$6,266  Subtotal  Nevada Sales Tax 3.75% \$32,021 \$32,812 \$64,833  Subtotal  Contractor Overhead & Profit 25.0% \$16,516  Subtotal  Estimating Contingency 10.0% \$82,578	(BELOW-GRADE PIPING: STM PI	PE IN CO	ONDUI	T & COND	ENSATE PI	PE IN CONF	DUIT	
TRENCH/BACKFILL           DIRT & LAWN         30         LF         \$7.12         \$214         \$0.00         \$0         \$214           R/R TRACK         1         EA         \$750.00         \$750         \$0.00         \$0         \$750           STEAM PITS         1         EA         \$1,450         \$1,450         \$4,816         \$4,816         \$6,260           Subtotal         \$32,021         \$32,812         \$64,833           Nevada Sales Tax         \$1,230         \$1,230         \$1,230           Subtotal         \$66,063           Contractor Overhead & Profit         25.0%         \$16,516           Subtotal         \$82,579           Estimating Contingency         10.0%         \$8,258	6-inch/3-inch							\$43.790
DIRT & LAWN         30         LF         \$7.12         \$214         \$0.00         \$0         \$214           R/R TRACK         1         EA         \$750.00         \$750         \$0.00         \$0         \$750           STEAM PITS         1         EA         \$1,450         \$1,450         \$4,816         \$4,816         \$6,266           Subtotal         \$32,021         \$32,812         \$64,833           Nevada Sales Tax         \$1,230         \$1,230         \$1,230           Subtotal         \$66,063         \$66,063           Subtotal         \$16,516         \$82,579           Estimating Contingency         10.0%         \$8,258				4.50,7	7-0,-10	4.0	Ψ20,077	Ψ+0,700
R/R TRACK         1         EA         \$750.00         \$750         \$0.00         \$0         \$750           STEAM PITS         1         EA         \$1,450         \$1,450         \$4,816         \$4,816         \$6,266           Subtotal         \$32,021         \$32,812         \$64,833           Nevada Sales Tax         \$1,230         \$1,230         \$1,230           Subtotal         \$66,063           Contractor Overhead & Profit         25.0%         \$16,516           Subtotal         \$82,579           Estimating Contingency         \$0.0%         \$8,258	TRENCH/BACKFILL							V
R/R TRACK         1         EA         \$750.00         \$0.00         \$0         \$750           STEAM PITS         1         EA         \$1,450         \$1,450         \$4,816         \$4,816         \$6,266           Subtotal         \$32,021         \$32,812         \$64,833           Nevada Sales Tax         \$1,230         \$1,230         \$1,230           Subtotal         \$66,063           Contractor Overhead & Profit         25.0%         \$16,516           Subtotal         \$82,579           Estimating Contingency         \$0.00         \$750           \$10.0%         \$25.0%         \$25.0%           \$25.0%         \$25.0%         \$25.0%	DIRT & LAWN	30	LF	\$7.12	\$214	\$0.00	\$0	\$214
STEAM PITS         1         EA         \$1,450         \$1,450         \$4,816         \$6,266           Subtotal         \$32,021         \$32,812         \$64,833           Nevada Sales Tax         3.75%         \$1,230         \$1,230         \$1,230           Subtotal         \$66,063         \$66,063         \$16,516           Subtotal         \$82,579         \$82,579           Estimating Contingency         10.0%         \$8,258	R/R TRACK	1	EA					
Subtotal         \$32,812         \$64,833           Nevada Sales Tax         3.75%         \$1,230         \$1,230           Subtotal         \$66,063         \$16,516           Contractor Overhead & Profit         25.0%         \$16,516           Subtotal         \$82,579           Estimating Contingency         10.0%         \$8,258	STEAM PITS							
Nevada Sales Tax       3.75%       \$1,230       \$1,230         Subtotal       \$66,063         Contractor Overhead & Profit       25.0%       \$16,516         Subtotal       \$82,579         Estimating Contingency       10.0%       \$8,258	Subtotal			,		, ,,-,-		\$64,833
Subtotal         \$66,063           Contractor Overhead & Profit         25.0%         \$16,516           Subtotal         \$82,579           Estimating Contingency         10.0%         \$8,258	Nevada Sales Tax	3.75%			. ,			
Contractor Overhead & Profit         25.0%         \$16,516           Subtotal         \$82,579           Estimating Contingency         10.0%         \$8,258	Subtotal						+ - 1	
Subtotal         \$82,579           Estimating Contingency         10.0%         \$8,258	Contractor Overhead & Profit	25.0%						
Estimating Contingency 10.0% \$8,258	Subtotal							
	Estimating Contingency	10.0%						\$8,258
Total Probable Construction Cost \$90.837	Total Probable Construction Cost						]	\$90,837
400,007		g Steam	and C	ondensate	Pipina & Fitt	inas		\$141.49

CONSTRUCTION COST ESTIMATE			******		Date Prepared	<u> </u>	Sheet	of
Coll   Modernize   Ordinance   Area   Steam   Distribution   PN-42166		OST E	STIM	IATE	1		1	
Code A (no design competed)   Code A (no design competed)	1	****				Basis for Estin	nate	
Hawthorne Army Ammunition Depot, Nevada   Code A (no design competed)	ECIP Modernize Ordnance Ar	ea Stea	am Dis	stribution	PN-42166			
Engineer-Architect   Keller & Gannon	Location					1		
Engineer-Architect   Keller & Gannon	Hawthorne Army Amm	unition	Depo	t. Nevad	а	Code A	Ino docian co	mnotod)
Drawing No.   Replace Piping from MH A5 - Bidg 103-40   DLN   Bidge   DLN   DLN   Bidge   DLN   DLN   Bidge   DLN   DLN   Bidge   DLN	Engineer-Architect			1,		1 00000 7	(no design co	inpeted)
Replace Piping from MH A5 - Bldg 103-40   DLN	Keller & Gannon							
Replace Piping from MH A5 - Bldg 103-40   DLN	Drawing No.				Estimator	Checked By		
Cline   Item	Replace Piping from MH	A5 - B	ldg 10	3-40	DLN	'	BIH	
Continue   Continue						Mat		
(Aboveground piping: built-up steam & condensate lines with insulation & aluminum jackets) 3-inch/1 1/2-inch 355	Line Item			1				Total
3-inch/1 1/2-inch 355	/Ab				Total	Per Unit	Total	Cost
SUPPORTS	(Aboveground piping: built-up stear							
STEAM VALVES   3-inch						\$19.73	\$7,003	\$19,403
3-inch		12	EA	\$337.01	\$4,044	\$290.00	\$3,480	\$7,524
COND VALVES 1 1/2-inch								
1 1/2-inch		1	EA	\$146.75	\$147	\$727.35	\$727	\$874
STEAM TEES   3-inch   2								
3-inch 2 EA \$190.90 \$382 \$49.85 \$100 \$482  45 ELBOWS (COMMON) 3-inch/2-inch 2 EA \$207.29 \$415 \$59.74 \$119 \$534  80 ELBOW (COMMON) 3-inch/1 1/2-inch 4 EA \$207.29 \$829 \$61.14 \$245 \$1,074  ELBOWS (SINGLE-COND) 1 1/2-inch 2 EA \$86.54 \$173 \$23.63 \$47 \$220  3-inch/1 1/2-inch 1 EA \$24.15 \$24 \$147.50 \$148 \$172  3-inch/1 1/2-inch DRIP NIPPLE 1 EA \$21.50 \$22 \$33.00 \$33 \$55  3-inch/1 NIPPLE 1 EA \$21.50 \$22 \$33.00 \$33 \$55  3-inch/1 III \$30,553  3-inch/1 III \$30,055  3-inch/1 III \$30,05  3-inch/1 III \$30,055  3-in		1	EA	\$76.98	\$77	\$139.58	\$140	\$217
## FLBOWS (COMMON)   3-inch/2-inch   2   EA   \$207.29   \$415   \$59.74   \$119   \$534     3-inch/1 1/2-inch   4   EA   \$207.29   \$829   \$61.14   \$245   \$1,074     4   EBOWS (SINGLE-COND)   5-inch/1 1/2-inch   2   EA   \$86.54   \$173   \$23.63   \$47   \$220     5-inch/1 1/2-inch   1   EA   \$24.15   \$24   \$147.50   \$148   \$172     5-inch DRIP NIPPLE   1   EA   \$21.50   \$22   \$33.00   \$33   \$55     5-inch DRIP NIPPLE   1   EA   \$21.50   \$22   \$33.00   \$33   \$55     5-inch DRIP NIPPLE   1   EA   \$21.50   \$22   \$33.00   \$33   \$55     5-inch DRIP NIPPLE   1   EA   \$21.50   \$22   \$33.00   \$33   \$55     5-inch DRIP NIPPLE   1   EA   \$21.50   \$22   \$33.00   \$33   \$55     5-inch DRIP NIPPLE   1   EA   \$21.50   \$25   \$35   \$35     5-inch DRIP NIPPLE   1   \$30,553   \$452   \$452     5-inch DRIP NIPPLE   1   \$30,553   \$452   \$452     5-inch DRIP NIPPLE   1   \$31,005   \$31,005     5-inch DRIP NIPPLE   1   \$31,005   \$31,005     5-inch DRIP NIPPLE   1   \$31,005   \$31,005     5-inch DRIP NIPPLE   1   \$31,005   \$33,876     5-inch DRIP NIPPLE   1   \$30,876     5-inch DRIP NIPPLE   1   \$33,876								
3-inch/2-inch 2 EA \$207.29 \$415 \$59.74 \$119 \$534 \$0 ELBOW (COMMON) 3-inch/1 1/2-inch 4 EA \$207.29 \$829 \$61.14 \$245 \$1,074 \$119 \$119 \$110 \$110 \$110 \$110 \$110 \$110		2	EA	\$190.90	\$382	\$49.85	\$100	\$482
## Spans	······································							
## Subtotal    South Common   Section   Subtotal   Subt		2	EA	\$207.29	\$415	\$59.74	\$119	\$534
ELBOWS (SINGLE-COND)  1 1/2-inch  GUIDES  3-inch/1 1/2-inch  1 EA \$24.15 \$24 \$147.50 \$148 \$172  C-inch DRIP NIPPLE  1 EA \$21.50 \$22 \$33.00 \$33 \$55  Subtotal  Nevada Sales Tax  Subtotal  Contractor Overhead & Profit  Contractor Overhead & Profit  Subtotal					".			
### Subtotal ####  Subtotal #### Subtotal #### Subtotal ##### Subtotal ##### Subtotal ##### Subtotal ##### Subtotal ###### Subtotal ###### Subtotal ####### Subtotal ####################################		4	EA	\$207.29	\$829	\$61.14	\$245	\$1,074
Suldes   S								<u> </u>
Solition   Solition		2	EA	\$86.54	\$173	\$23.63	\$47	\$220
Miscellaneous Fittings   2-inch DRIP NIPPLE   1   EA   \$21.50   \$22   \$33.00   \$33   \$55    - Subtotal   \$18,512   \$12,041   \$30,553    - Nevada Sales Tax   3.75%   \$452   \$452    - Subtotal   \$31,005    - Contractor Overhead & Profit   25.0%   \$7,751    - Subtotal   \$38,756    - Subtotal								,
Miscellaneous Fittings   2-inch DRIP NIPPLE   1   EA   \$21.50   \$22   \$33.00   \$33   \$55		1	EA	\$24.15	\$24	\$147.50	\$148	\$172
Subtotal       \$18,512       \$12,041       \$30,553         Nevada Sales Tax       3.75%       \$452       \$452         Subtotal       \$31,005         Contractor Overhead & Profit       25.0%       \$7,751         Subtotal       \$38,756         Estimating Contingency       \$3,876         Total Probable Construction Cost       \$42,631						***************************************		<u> </u>
Subtotal       \$18,512       \$12,041       \$30,553         Nevada Sales Tax       3.75%       \$452       \$452         Subtotal       \$31,005         Contractor Overhead & Profit       25.0%       \$7,751         Subtotal       \$38,756         Estimating Contingency       \$3,876         Total Probable Construction Cost       \$42,631		1	EA	\$21.50	\$22	\$33.00	\$33	\$55
Nevada Sales Tax       3.75%       \$452       \$452         Subtotal       \$31,005         Contractor Overhead & Profit       25.0%       \$7,751         Subtotal       \$38,756         Estimating Contingency       10.0%       \$3,876         Total Probable Construction Cost       \$42,631	Subtotal							
\$31,005	Nevada Sales Tax	3.75%						
Contractor Overhead & Profit         25.0%         \$7,751           Subtotal         \$38,756           Estimating Contingency         10.0%         \$3,876           Total Probable Construction Cost         \$42,631	Subtotal						7.00	
Subtotal\$38,756Estimating Contingency10.0%\$3,876Total Probable Construction Cost\$42,631	Contractor Overhead & Profit	25.0%						
Stimating Contingency 10.0% \$3,876  Total Probable Construction Cost \$42,631	Subtotal							
otal Probable Construction Cost \$42.631	Estimating Contingency	10.0%						
942,031	Total Probable Construction Cost							
Average Cost per Linear Foot Including Steam and Condensate Piping & Fittings \$60.04	Average Cost per Linear Foot Includin	g Steam	and Co	ondensate	Pipina & Fitt	ings		

				Date Prepared	3	Sheet	of
CONSTRUCTION CO	OST E	STIM	IATE		mber-95	6	7
Project ECIP Modernize Ordnance A	rea Ste	am Di	stribution	Project No. PN-42166	Basis for Estir	mate	
Location	ou oto.	uiii Di	Stribution	1114-42100	-		
Hawthorne Army Amn	nunition	Depo	t, Nevad	а	Code A	(no design c	ompeted)
Engineer-Architect					1	`	,
Keller & Gannon							
Drawing No.				Estimator	Checked By		
Replace Pipes from Buildi	ng 103	-6 to	MH C3	DLN		BIH	
		antity		abor	Mai	terial	
Line Item	No. Units	Unit Meas	Per Unit	Total	Per Uni	t Takal	Total
(Aboveground piping: built-up stea							Cost
4-inch/ 2-inch	627	LF	\$43.27	\$27,132	\$17.94		\$20.270
SUPPORTS	28	EA	\$337.01	\$9,297	\$290.00	\$11,247	
STEAM VALVES	1 20	<del> </del>	Ψ557.01	ψ9,291	\$290.00	\$8,001	\$17,298
4-inch	2	EA	\$202.53	\$405	\$929.92	\$1,860	\$2.265
COND VALVES	+	1	Ψ202.00	\$403	\$929.92	\$1,000	\$2,265
2-inch	2	EA	\$99.75	\$200	\$182.27	\$365	\$564
1 1/2-inch	4	EA	\$76.98	\$308	\$139.58	\$558	\$866
STEAM TEES			Ψ/0.30	\$300	Ψ139.36	\$336	\$000
4-inch	2	EA	\$215.69	\$431	\$62.14	\$124	\$556
COND TEES			Ψ2.10.00	Ψ-51	Ψ02.14	ψ12 <del>4</del>	\$550
2-inch	4	EA	\$139.10	\$556	\$41.87	\$167	\$724
90 ELBOW (COMMON)	<b>-</b>		Ψ100.10	Ψ000	Ψ-11.07	\$107	\$124
4-inch/2-inch	8	EA	\$260.24	\$2,082	\$38.80	\$310	\$2,392
ELBOWS (SINGLE-COND)			Ψ200.2 I	Ψ2,002	Ψ00.00	Ψ510	Ψ2,332
1 1/2-inch	5	EA	\$86.54	\$433	\$23.63	\$118	\$551
ANCHORS			,	<u> </u>	420.00	<b>\$110</b>	4001
4-inch/2-inch	2	EA	\$59.46	\$119	\$49.08	\$98	\$217
GUIDES				, , , , , , , , , , , , , , , , , , , ,	¥ 75.55	700	Ψ211
4-inch/2-inch	2	EA	\$27.65	\$55	\$219.00	\$438	\$493
Miscellaneous Fittings							7.13
2-inch DRIP NIPPLE	2	EA		\$0		\$0	\$0
1 1/2-inch'Steam Trap Assembly	2	EA	\$168.12	\$336	\$1,000.50	\$2,001	\$2,337
STM GAGE	1	EA	\$140.00	\$140	\$2,025.00	\$2,025	\$2,165
PRESSURE GAGE	1	EA	\$7.30	\$7	\$16.50	\$17	\$24
BELOW-GRADE PIPING: STM PI	PE IN CC	NDUIT	& COND	PIPE IN CO	NDUIT		<u> </u>
4-inch/ 2-inch	70	LF	\$65.52	\$4,586	\$56.29	\$3,940	\$8,527
TRENCH/BACKFILL							
DIRT & LAWN	10	LF	\$7.12	\$71	\$0.00	\$0	\$71
CONCRETE ROAD	60	LF	\$23.78	\$1,427	\$0.00	\$0	\$1,427
R/R TRACK	4	EA	\$750.00	\$3,000	\$0.00	\$0	\$3,000
STEAM PITS	6	EΑ	\$1,450	\$8,700	\$4,816.00	\$28,896	\$37,596
Subtotal				\$59,286		\$60,165	\$119,451
Nevada Sales Tax	3.75%					\$2,256	\$2,256
Subtotal						. ,	\$121,708
Contractor Overhead & Profit	25.0%				***************************************		\$30,427
Subtotal							\$152,135
Estimating Contingency	10.0%						\$15,213
Total Probable Construction Cost							\$167,348
Average Cost per Linear Foot Includir	ng Steam	and C	ondensate	Piping & Fitt	ings		\$120.05

				Date Prepared		Sheet	of
CONSTRUCTION CO	SIE	STIM	ATE	Septer	mber-95	7	7
Project			*****	Project No.	Basis for Estin	nate	
ECIP Modernize Ordnance Are	ea Stea	am Dis	stribution	PN-42166			
Location							
Hawthorne Army Amm	nunition	Plant	t, Nevada	3	Code A	(no design co	mpeted)
Engineer-Architect	***************************************		<u> </u>			, <b>.</b>	,
Keller & Gannon							
Drawing No.				Estimator	Checked By		• • • • • • • • • • • • • • • • • • • •
Replace Pipes from MH	B8 to	MH B	9-1	DLN		BIH	
1		intity		abor	Mat	erial	
Line Item	No. Units	Unit Meas.	Per Unit	Total	Per Unit	~	Total
(Aboveground piping: built-up stear							Cost
4-inch/ 2-inch	250	LF	\$43.27	\$10,818	\$17.94		£45.200
SUPPORTS	7	EA	\$337.01	\$2,359	\$290.00	\$4,484	\$15,302
STEAM VALVES	<del>  '</del>	<del>  -</del> ^	Ψ337.01	Ψ2,309	φ∠30.00	\$2,030	\$4,389
4-inch	1	EA	\$202.53	\$203	\$929.92	<b>6020</b>	C4 400
COND VALVES	<u>'</u>		Ψ202.55	\$203	ψ <del>9</del> 29.92	\$930	\$1,132
2-inch	1	EA	\$99.75	\$100	\$182.27	\$182	#202
45 ELBOWS (COMMON)	<u>'</u>		ψ99.73	\$100	\$102.27	<b>⊅10</b> ∠	\$282
4-inch/2-inch	2	EA	\$260.24	\$520	\$42.70	\$85	<b>\$606</b>
90 ELBOW (COMMON)	<del>                                     </del>	<del></del>	Ψ200.24	Ψ <b>02</b> 0	Ψ42.70	400	\$606
4-inch/2-inch	4	EA	\$260.24	\$1,041	\$38.80	\$155	\$1,196
ELBOWS (SINGLE-COND)	<u> </u>		Ψ200.Z-T	Ψ1,0-11	Ψ30.00	\$100	का, 190
2-inch	2	EA	\$103.65	\$207	\$31.32	\$63	\$270
1 1/2-inch	5	EA	\$86.54	\$433	\$23.63	\$118	\$551
GUIDES			Ψ00.01	Ψ+00	Ψ20.00	Ψ110	<b>क्</b> ठ्या
4-inch/2-inch	1	EA	\$25.80	\$26	\$208.50	\$209	\$234
Miscellaneous Fittings			720.00	<del>\$20</del>	Ψ200.00	Ψ203	ΨZ 0 <del>-1</del>
2-inch DRIP NIPPLE	1	EA	\$21.50	\$22	\$33.00	\$33	\$55
1 1/2-inch'Steam Trap Assembly	1	EA	\$168.12	\$168	\$1,000.50	\$1,001	\$1,169
			.,	7.00	7.,000.00	Ψ1,001	Ψ1,100
BELOW-GRADE PIPING: STM PIP	E IN CO	NDUIT	& CONDE	NSATE PIP	E IN COND	JIT	
4-inch/ 2-inch	30	LF	\$62.09	\$1,863	\$56.29	\$1,689	\$3,551
				,		, ,,,,,,,,	+ 3,001
TRENCH/BACKFILL							
CONCRETE ROAD	30	LF	\$23.78	\$713	\$0.00	\$0	\$713
STEAM PITS	1	EA	\$1,450	\$1,450	\$4,816.00	\$4,816	\$6,266
Subtotal				\$19,922		\$15,795	\$35,717
Nevada Sales Tax	3.75%					\$592	\$592
Subtotal							\$36,309
Contractor Overhead & Profit	25.0%						\$9,077
Subtotal							\$45,387
Estimating Contingency	10.0%						\$4,539
Total Probable Construction Cost							\$49,925
Average Cost per Linear Foot Includin	a Stoom	and Co	ndonasta	Dining 9 Fix			\$89.15